

"We will specify Mead's Capsules
of Viosterol in Halibut Liver Oil 250 D
when Mead puts them on the market"

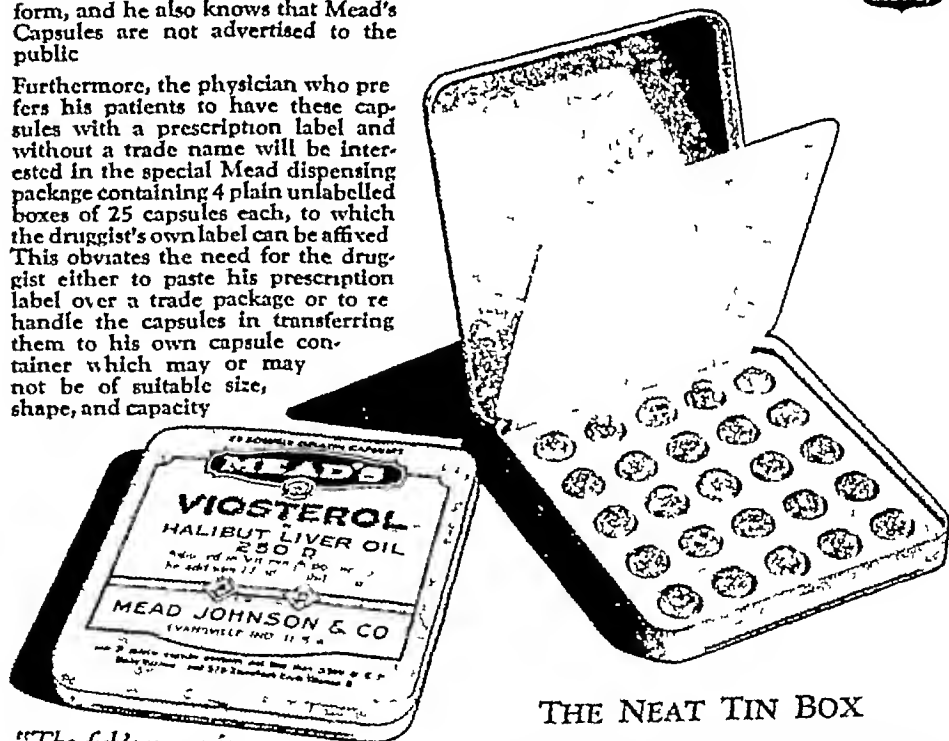
— many physicians told us.

so now—by request we offer CAPSULES

MEAD'S VIOSTEROL IN HALIBUT LIVER OIL 250 D.
Each 3-minim capsule supplies not less than 5,500 U.S.P.
Vitamin A units and 570 Steenbock Vitamin D units.

WHEN recommending Mead's Capsules, the physician is now assured of the same high grade product which is marketed by Mead in liquid form, and he also knows that Mead's Capsules are not advertised to the public

Furthermore, the physician who prefers his patients to have these capsules with a prescription label and without a trade name will be interested in the special Mead dispensing package containing 4 plain unlabelled boxes of 25 capsules each, to which the druggist's own label can be affixed. This obviates the need for the druggist either to paste his prescription label over a trade package or to rehandle the capsules in transferring them to his own capsule container which may or may not be of suitable size, shape, and capacity



THE NEAT TIN BOX

contains 25 Mead Capsules and assures maximum protection in all climates and seasons to both capsules and clothing. No additional charge for this convenient fine package. Specify MEAD'S—not advertised to the public.

"The fish's name is
HALIBUT"—
Specify MEAD'S

MEAD JOHNSON & COMPANY, Evansville, Indiana, U.S.A.

Please contact your distributor when requesting samples of Mead Johnson products to cooperate in preventing their reaching unauthorized persons

DEXTRI-MALTOSE, over 23 years, CARBOHYDRATE OF CHOICE

1911

"The limits of assimilation of the different sugars vary and are as follows:

"Grape sugar. In babies, about 5 grams per kilogram (Langstein and Meyer)

"Grape sugar. In one-month baby 8.0 grams per kilogram (Greenfield)

"Galactose. No accurate data.

"Levulose. (Lower for babies than adults.) One gram per kilogram (heller)

"Maltose. Over 7.7 grams per kilogram (Reuss)

"Lactose. 3.1-3.6 grams per kilogram (Gross)

"Cane sugar. Probably about the same as lactose (Reuss) — *J. L. Moore and F. B. Talbot Physiology and pathology of the digestion of the carbohydrates in infancy Boston M. & S. J., 164:332-335 Jan 15 1911*

1912

"Maltose has for many years been considered one of the most valuable of infant foods in modifying milk for mulsas, but the German school in the last few years has called special attention to the value of this sugar as a substitute for milk and cane sugars in conditions of intestinal fermentation. It is more easily assimilated and more rapidly absorbed than lactose or saccharose and it may be taken therefore by the infant in larger quantities without producing sugar fermentation.

"Maltose is especially indicated in the feeding of very young and delicate infants, and in all cases where either milk or cane sugar has produced intestinal fermentation and sugar intoxication. In the feeding of maltose it has been found advisable to combine it with about equal parts of dextrin. In Germany and later in this country, 'Soxhlet's Nährzucker' (which contains maltose 62.44 per cent., dextrin 41.26 per cent., and sodium chloride 2 per cent.) has been largely used. 'Mead's Dextrin-Maltose' (malt sugar), which contains about equal parts of dextrin and maltose, is a simpler preparation which may be used instead of milk sugar or cane sugar for modifying milk mixtures. — *B. A. Rackford, Diseases of Children, D. Appleton & Co. New York, 1912 p 185*

1913

"It is well to start with one ounce (albumin milk, or albumin-buttermilk) to every pound of body weight in the twenty-four hours, increasing gradually until two or three ounces to the pound of body-weight are being given. Then add sugar preferably a malt sugar about one-fourth of an ounce at a time to the twenty-four-hour quantity until 1 ounce or an ounce and a half is being given. — *J. Foster Principles of treatment in malnutrition and atrophy of infants Interstate M. J., 20:1915 No 6*

1914

"Milk sugar and cane sugar may be used in infant feeding, but my preference is for malt sugar. Mead and Johnson put up a convenient preparation which they call Dextrin Maltose and which consists of maltose 51 per cent., dextrin 47 per cent., sodium chloride 2 per cent., and which has a food value of about 110 calories per ounce. — *J. A. Gernow, Whole milk in dilutions in feeding normal infants Washington Med. Annals 18:83-85 Jan. 1914*

1914

"Dextrin-maltose causes the greatest gain in weight, cane sugar less, a dextrose product the least gain. — *M. S. R. New Observations on milk station infants, Arch. Pediat. 31 176-180 March 1914*

1914

"A composite opinion of the sugars is in favor of dextrin maltose, milk sugar and cane sugar in the order named. — *R. V. Strong Essentials of modern artificial feeding of infants Lancet-Clinic March 14 1914.*

1914

"Experiments show that sugars vary in their rate of absorption, some being assimilated rapidly while others

distribute their nutriment over a longer period. For example maltose is most promptly assimilated, cane sugar next and milk sugar slowest.

"The condition in which dextrin maltose is particularly indicated is in acute attacks of vomiting, diarrhea and fever. It seems that recovery is more rapid and recurrence less likely to take place if dextrin-maltose is substituted for milk sugar or cane sugar when these have been used, and the subsequent gain in weight is more rapid.

"In brief I think it safe to say that pediatricians are relying less implicitly on milk sugar but are inclined to split the sugar element, giving cane sugar a place of value and dextrin-maltose a decidedly prominent place particularly in acute and difficult cases. — *W. D. Hoskins Present tendencies in infant feeding Indianapolis M. J. July 1914.*

1915

"In the severe cases (of diarrhea) he (Benson) uses Flakstein's casein milk with malt sugar. He also believes that dextrin maltose is to be preferred to milk sugar or any other sugar, as the infants gain more rapidly and digest more easily this form of sugar. — *R. A. Benson, Observations on 1,400 artificially-fed infants, Med. Century Feb., 1915 p 83 abstr. Arch. Pediat., 32 356-33 July 1915.*

1915

"Until very recently we have taken it for granted that milk sugar was the best, but now many consider that malt sugar is even better. However the malt sugar is not used in its pure state, but in the form of extracts, as dextrin-maltose. — *E. B. Lowry Your Baby Forbes & Co., Chicago, 1915 p 129*

1915

"Cane-sugar (saccharose), like most of the other disaccharids, is not absorbed as such, but must first be split by the invertase of the intestinal secretion into the two glucose, dextrose and levulose, which are readily absorbable. Maltose (malt-sugar) occupies an exceptional position among the disaccharids, in being partly absorbable as such. This is probably due to the fact that it can be split not only by the maltase of the digestive juices, but also by the same ferment being present and active in the circulating blood (Chittenden and Mendel)

"Anticipating a little, we may mention that if cases, in which lactase may advantageously be replaced by other carbohydrates, are pathological, and without exception the result of unsuccessful attempts at artificial feeding; they will therefore be discussed under that head.

"Dextrin, intermediate between sugar and starch is physiologically nearer to the former; we shall have occasion to see that, under certain conditions, it may supplement sugar very advantageously. Given together with maltose, it materially delays the fermentation of the latter; Stoltz observes that the more complex the carbohydrate the longer fermentation is postponed.

"All malted foods contain dextrin and this is a reason to believe that their value largely depends on their being somewhat complicated; such, at least, is the opinion of Usuki and Stoltz, who believe that a mixture of carbohydrates is more slowly absorbed than a pure sugar and therefore tends to check fermentation in the intestine. Southworth explains the matter more definitely by attributing the antifermentative action entirely to the dextrin, which is not fermentable as such, but only after it has been split into maltose, a process that takes place only gradually and in the later stages of digestion.

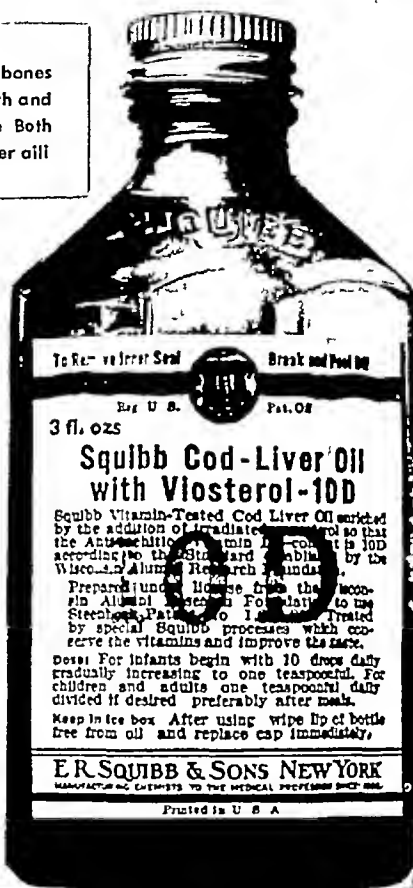
"I make it a rule to give the ordinary formula with dextrin-maltose whenever the usual milk or cane-sugar mixtures seem to cause excessive fermentation and colic, or are attended with the evacuation of soap stools. I decidedly prefer this, as a preliminary measure, to going over at once to some very low fat combination, which can only be a temporary makeshift at best. I also find dextrin-maltose an excellent addition to albumin-milk when the first object of that food has been achieved and a gain in weight is desired; in this way I have succeeded in feeding albumin milk far beyond the period usually advised, with highly gratifying results. — *F. L. Rackford, Infant Feeding Its Principles and Practice Lea & Febiger Phila., 1915 pp 81 83 140 158*

Continued down to 1934

MEAD JOHNSON & COMPANY, Evansville, Indiana, U S A

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Extra Vitamin D for building bones
and teeth! Vitamin A for growth and
as an aid in building resistance. Both
supplied by this richer cod liver oil!



SQUIBB COD-LIVER OIL *with*

Manufactured under license from the Wisconsin Alumni Research Foundation by E. R. Squibb & Sons Manufacturing

THERE'S really a *double* advantage in prescribing this richer cod liver oil of Squibb's. From the standpoint you're most interested in—rickets-prevention—it's unusually effective. This is because extra Vitamin D in the form of Viosterol in Oil 250 D has been added.

The other feature about this fortified cod liver oil is its richness in Vitamin A, a factor which may be particularly important for young babies in the active stage of development. It is now well established that Vitamin A has definite *growth promoting* properties. Many authorities also believe that Vitamin A may aid in building resistance.

Both vitamins are extremely important for young babies. And with Squibb's Cod-Liver Oil with Viosterol 10D you have the assurance babies will get enough of both factors.

It has *ten times* the anti-rachitic value of the standard cod liver oil defined by the Wisconsin Alumni Research Foundation. Each gram contains not less than 1333 A.D.M.A. (133 Steenbock) units of Vitamin D and not less than 1250 U.S.P. units of Vitamin A. Have mothers give it to babies regularly *every day*.

For older children suggest the Mint Flavored! Mothers have no trouble getting them to take this pleasant tasting oil. Recommend its daily use—Squibb Mint Flavored Cod-Liver Oil with Viosterol 10D.

A splendid routine

for babies who are

growing rapidly and need

a *richer*

cod-liver oil

VIOSTEROL 10 D

Chemists to the Medical Profession Since 1858

CONSIDER THESE SOURCES



from wholesome
WHEAT and BARLEY—
Maltose, Dextrins
AND MORE

Wheat flour, wheat bran and malted barley are converted into maltose and dextrins, by *natural enzymatic action*, in making Mellin's Food. Cereal protein and mineral salts, present in the whole grain, are retained. Mellin's Food has 58.9% Maltose, 20.7% Dextrins, 10.3% Cereal Protein, and 3.9% Ash.

The tendency of Mellin's Food to promote normal bowel action is well known.

MELLIN'S FOOD CO
Boston, Mass

LITERATURE AND SAMPLES OF MELLIN'S FOOD GLADLY SUPPLIED—TO PHYSICIANS

Mellin's Food Prepared by an infusion of Water, Lemon Juice, and Malted Barley, admixed with Patent Malt Extract—containing nearly all of Maltose, Dextrins, Protein, and Mineral Salts.



"PLEASE, DOCTOR —DON'T SAY MILK!"

No doubt many little patients would like to "nip off" the doctor beforehand. Milk can become so monotonous—the sameness of taste—the sameness of color.

Cocomalt mixed with milk is quite another story! Children adore its creamy chocolate flavor. And prepared as directed, Cocomalt adds 70% more caloric value to milk. It provides extra proteins, carbohydrates, minerals (calcium and phosphorus)—plus Vitamin D for proper utilization of the calcium and phosphorus. It is licensed by the Wisconsin University Alumni Research Foundation.

Cocomalt comes in powder form, easy to mix with milk—delicious HOT or COLD. Sold at grocery and good drug stores in ½-lb. and 1 lb. air tight cans. Available also in 5 lb. cans for hospital use, at a special price.

Cocomalt is accepted by the Committee on Food of the American Medical Association. It is composed of sweetened skim milk, selected cocoa, barley malt extract, flavoring, and added Vitamin D.



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We will be glad to send a trial size can of Cocomalt free to any doctor requesting it. If you send this coupon with your name and address.

R. B. Davis Co., Dept. 34C
Hoboken, N. J.

Please send me a trial-size can of Cocomalt without charge.

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Street _____
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In acute illnesses

Appetite wanes, digestion is impaired, but energy requirements remain high

A liberal supply of carbohydrate provides energy and spares protein destruction

The tolerance for Karo Syrup is high, even in the presence of fever

Karo Syrup does not overtax the digestion, does not impair the appetite through excessive sweetness, improves the flavor of fruit juices, milk and cereals

Karo is rich in Dextrins, Maltose and Dextrose—all recommended for ease of digestion and energy value

FREE TO PHYSICIANS

This convenient calculator of feeding schedules is accurate, instructive and helpful. The makers of Karo will gladly send one to you on receipt of your name and address. Please enclose your prescription blank or professional card.

Write to



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17 BATTERY PLACE • NEW YORK CITY

S M A The Antirachitic Breast Milk Adaptation

SO SIMPLE

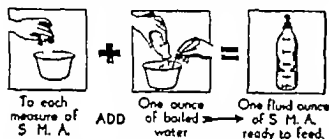
that even Mrs. ———— can prepare it properly

SO SIMPLE

that Mrs. ———— will thank you for sparing her
much worry and trouble

(† No doubt you can supply names from your practice)

ANYONE CAN FOLLOW THESE SIMPLE INSTRUCTIONS



This proportion remains unchanged. As the infant grows older you merely increase the quantity as with breast milk (See table below)

SAVES PHYSICIAN'S TIME TOO

S M A is simple to prescribe. The physician is relieved of exacting detail because he has only to increase the *amount* of S M A (as with breast milk) when in his judgment it becomes necessary. The accompanying chart suggests average amounts.

The physician's time is also saved because the chances are good for excellent results under his skilled supervision.

SUGGESTED FEEDING TABLE

Infant	Total Quantity In 24 Hours In Ounces	No. of Feedings	Quantity per Feeding In Ounces
2 days	1 to 2½	2 to 3	½ to 1
3 days	2½ to 5	3 to 4	½ to 1½
4 days	5 to 7½	4 to 5	1 to 1½
5 days	7½ to 10	5 to 7	1 to 2
6 days	10 to 12½	5 to 7	1½ to 2½
7 days	12½ to 15	5 to 7	2 to 3
2 weeks	15 to 17½	5 to 7	2 to 3½
4 weeks	17½ to 20	5 to 7	2½ to 4
6 weeks	20 to 22½	5 to 7	3 to 4½
2 months	22½ to 25	5 to 6	3½ to 5
2½ months	25 to 27½	5 to 6	4 to 5½
3 months	27½ to 30	5	5½ to 6
3½ months	30 to 32½	5	6 to 6½
4 months	32½ to 35	5	6½ to 7
5 months	35 to 37½	5	6½ to 7½
6 months to 1 year	37½ to 40	5 to 4	6½ to 10

6 to 7 Mos. At this age it is customary to add soups and vegetables to the diet especially spaghetti.

* These quantities refer to fluid ounces of S M A, diluted according to directions.

TIME SCHEDULE

7 feedings: 6, 9, 12, 3, 6, 9 and once during night.
6 feedings: 6, 9, 12, 3, 6 and 9 or later
5 feedings: 6, 10, 2, 6, 10 and 2
4 feedings: 6, 10, 2, 6 and 10 or 1 ter
3 feedings: 6, 9, 12, 3 and 6 or later

NUMBER OF FEEDINGS IN 24 HOURS

The number of feedings in 24 hours should likewise be the same as those allowed breast-fed infants; generally stated not more than seven and not less than five. However when the infant reaches the age of 6 to 7 months, it is customary to replace one of the feedings with an 6 ounce meal of farina broth soup.

S M A RESEMBLES BREAST MILK

S M A is a food for infants—derived from tuberculin tested cows milk the fat of which is replaced by animal and vegetable fats including biologically tested cod liver oil, with the addition of milk sugar potassium chloride, and salts, altogether forming an *antirachitic food*. When diluted according to directions, it is *essentially similar to human milk* in percentages of protein, fat, carbohydrates and ash in chemical constants of the fat and in physical properties.

ETHICAL OF COURSE

If babies were all alike, it might not be quite so necessary to have a physician plan and supervise feedings. However from the very beginning every package of S M A has carried these instructions prominently on the label. *Use only on order and under supervision of a licensed physician. He will give you instructions.*



S M A CORPORATION
CLEVELAND OHIO

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S M A PRODUCES RESULTS - MORE SIMPLY, MORE QUICKLY



Gerber's
Vegetables

Gerber

Strained Vegetables

Fremont Canning Co.

SEED, SOIL and SUNSHINE
start the job of making
Gerber products
"BETTER FOR BABY!"

With scrupulous care the best of seeds are selected. They're planted in the rich, fertile soil of sunny Michigan fields. The soil is further enriched with the necessary minerals and other elements for proper development of the plants. Through every stage of germination and growth they're cultivated and tended with strictest care. Then, at the precise moment of their ripe perfection they're harvested and rushed in covered trucks to Gerber plants. Processing begins at just the right stage of perfection.

Crisp, ripe, freshest of vegetables are the only kind that go into Gerber

products. That's one important reason why so many mothers and doctors agree that Gerber's are "Better for Baby."

In fact, only vegetables grown and picked in one's own garden and served immediately can possibly be as fresh as those used in Gerber's. But home preparation lacks, of course, the specially designed equipment that preserves natural vitamin and mineral salt values during the Gerber scientific cooking and straining processes.

Protection at the source is just one of the steps in the Gerber process which enable us to say that no baby can be served better foods than Gerber's Strained Vegetables and Cereal.

Gerber's

9 STRAINED FOODS FOR BABY

Strained Tomatoes Green Beans
Beets Vegetable Soup Carrots
Prunes Peas Spinach 4½-oz. cans
Strained Cereal 10½-oz. cans 15c



GERBER PRODUCTS COMPANY, Fremont, Michigan
(In Canada: Fine Foods of Canada, Ltd. Windsor, Ont.)
Please ☐ Reprint of the article The Nutritive Value
send me ☐ of Strained Vegetables in Infant Feeding
☐ Sample can of Gerber's Strained Cereal 10½-oz.

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RAPIDLY GAINING FAVOR

ALERDEX - THE PROTEIN-FREE MALTOSE AND DEXTRINS

WHY IS ALERDEX PROTEIN-FREE?

● Since certain proteins are frequently the cause of eczemas and other forms of allergy it is desirable to eliminate these offending proteins from the infant diet. Cereal proteins are frequently present as contaminants in some milk modifiers. The routine use of a protein free carbohydrate in all milk modifications should help to diminish the incidence of these troublesome eczemas. Alerdex is a protein free carbohydrate developed by our Research Division to meet this need and the demand for it is steadily increasing.

A modest announcement of Alerdex a year ago found physicians ready and anxious for such a product. There is now a definite trend to use Alerdex routinely in all milk formulas.

Of course Alerdex should always be used as the carbohydrate addition with Smaco Hypo Allergic Milks with the assurance that eczemas due to cereal protein sensitization will not be aggravated.

CHARACTERISTICS OF ALERDEX

- 1 Helps prevent eczemas when used routinely due to absence of offending protein.
- 2 Use present formulas because Alerdex has same caloric value and percentage of maltose and dextrins.
- 3 Does not cake on exposure to air because it is non hygroscopic.
- 4 Dissolves readily in warm water or milk.
- 5 Snow white, free flowing powder.
- 6 Inexpensive—in spite of extra processing under technical control, costs no more.

APPROXIMATE ANALYSIS OF ALERDEX

Alerdex is essentially a mixture of approximately equal parts of maltose and dextrins. It is prepared by new thermally-controlled process of the enzymic hydrolysis of non cereal starch, as a result of which it contains no protein contaminants.

Moisture	3.0
Ash	0.5
Fat (ether extract)	0.0
Hydrolyzed protein (N x 6.25)	0.05
Reducing sugars as maltose	50.0
Dextrins (by difference)	48.0
Level tablespoons, per ounce	4
Calories per level tablespoon	27½
Calories, per ounce	110



Prescribe Alerdex in your own practice. For samples and literature simply attach this paragraph to your letterhead prescription blank. S.M.A. Co. postal 4814 Prospect Avenue Cleveland, Ohio 50-31

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Fremont Canning Co.

SEED, SOIL and SUNSHINE
start the job of making
Gerber products
"BETTER FOR BABY!"

With scrupulous care the best of seeds are selected. They're planted in the rich, fertile soil of sunny Michigan fields. The soil is further enriched with the necessary minerals and other elements for proper development of the plants. Through every stage of germination and growth they're cultivated and tended with strictest care. Then, at the precise moment of their ripe perfection they're harvested and rushed in covered trucks to Gerber plants. Processing begins at just the right stage of perfection.

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Fat (ether extract)	0.0
Hydrolyzed protein (N x 6.25)	0.05
Reducing sugars maltose	50.0
Dextrins (by difference)	49.0
Level tablespoon per ounce	4
Calories, per level tablespoon	27½
Calories, per ounce	110



Prescribe Alerdex in your own practice. For samples and literature simply attach this paragraph to your letterhead or prescription blank. S.M.A. Corporation 4614 Prospect Avenue Cleveland Ohio. 50-34

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Evaporated Milk ... IS STERILIZED

★ *"Bacillary dysentery is caused only by contaminated raw food So are a host of other milk borne diseases, as typhoid fever, scarlet fever, septic sore throat, and many others I think we all agree at the present time that no infant should take any milk that is not sterilized in some way"*

—ANDERSON, WM WILLIS, *Arch Ped*, July, 1933



Carnation Milk IS GOOD Evaporated Milk

Carnation Milk is sterilized under exact scientific control Then, to make safety doubly safe, the sealed cans are held in a "heat" room for several days under conditions which would uncover any instance of improper sterilization Carnation Milk may always be relied upon as a safe food for infants ★



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PREPARATION

IN THE DERMATOSES

the eczemas—diaper rash—scabies—pruritus—impetigo

INOTON (DEBAT)

offers "patient relief" with "patient satisfaction"

INOTON was developed by Debat, former chief Dermatological Laboratory, St Antoine Hospital, Paris. During the World War it had wide Dermatological usage by the French Medical Corps for the burns and flesh wounds of conflict.

THE Debat method combines two preparations—Inoton Ointment and Inoton Powder, each supplementing the other. Together they soothe and assist healing (no destruction of tissue). Debat has worked out clinically, a careful system for the use of Inoton in various dermatoses which may be followed or varied to suit the medication of the case.



Eczematous Impetigo before treatment with Inoton.



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Baby Ralston

the specially prepared wheat cereal
infants actually *enjoy*



Baby Ralston is a fine-textured cereal composed of wheat endosperm and embryo. As a starting cereal for infants it offers the following distinct advantages

Infants accept it eagerly because it tastes so good. Baby Ralston has the inviting appearance, the delicate aroma and delicious flavor of pure, high quality wheat

Mothers welcome it because it's so easy to prepare. Baby Ralston is thoroughly cooked and easily digested by the infant after five to ten minutes' cooking in a single boiler or twenty to thirty minutes in a double boiler. No straining or mixing is necessary—none of the trouble and uncertainty of mixing or adding concentrates. Baby Ralston is ready to feed to the infant just as it comes from the pan.

Physicians find it an ideal starting cereal because in one palatable, well tolerated food it provides an excellent source of energy (wheat endosperm) and an abundant supply of vitamin B (wheat embryo—one of nature's richest sources of this essential vitamin for normal appetite). In fact, one average infant serving of Baby Ralston provides as much vitamin B as a quart of milk.

Send for Research Report and Samples To assist you in prescribing Baby Ralston we will gladly send you our Laboratory Research Report together with a sample of the cereal for testing. Use the coupon below.

**RALSTON PURINA COMPANY, Department 1,
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Please send me a copy of your Laboratory Research Report on Baby Ralston and a sample for testing.

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COD LIVER OIL *for Infants*

BOND BREAD

for Children and Adults



'It is worthy of note that eggs are practically the only food normally included in the diet that provide significant amounts of vitamin D. It is indeed believed by some workers that if it could be a certainty that the eggs were produced under such conditions as to insure their maximum potency in vitamin D, they alone could be relied on to supply protective amounts of this factor. Since it is impossible to be assured of this, it is safer to assume that some other source of D should also be included.

Why cut off suddenly extra sources of vitamin D at the time when regular doses of cod liver oil or viosterol are discontinued? Bond Bread is such an easy way to provide a rich supply of this scarce vitamin. Moreover, vitamin-D is added to Bond Bread in uniform, scientifically controlled amounts. The acceptance of the Committee on Foods of the American Medical Association is proof enough that Bond Bread is a dependable rich source of vitamin-D. 95 Steenbock (950 ADMA) units to each pound of bread.

New Research on Tooth Decay

The latest research which studied the effect of vitamin D in the diets of 162 children, again shows the need of this important element. The results show that the group receiving vitamin-D developed an average of only 0.69 new cavities per child during the year, while in the group on the same diet, without the additional vitamin D, 1.54 new cavities per child developed. From the results it is evident that the addition of vitamin-D to the diet cut tooth decay in half. **

For further information address Dr. J. G. Coffin, Technical Director, General Baking Company, Dept. P 2, 420 Lexington Avenue, New York City.

Roberts—Scientific Feeding of Children—Journal of the American Dental Association, January 1934.

Conclusions from new research on Dental Caries, Department of Paediatrics, University of Toronto.



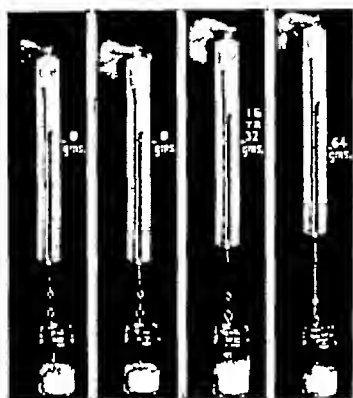
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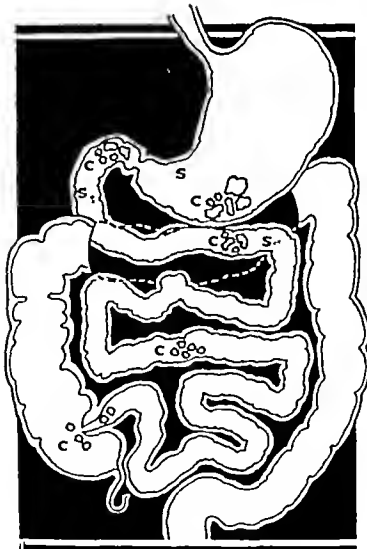
CURD TENSION

- AND INFANT FEEDING -

ITS • EFFECT • UPON • THE • ASSIMILATION • OF
PROTEINS



BREAST MILK SIMILAC POWDERED MILK COW'S MILK



C—Cow's milk S—Similac
Schematic drawing of the relative size of the curds of cow's milk and Similac vomited by six weeks old puppies after one half hour's ingestion

"THE most available and the most easily digestible form of protein for infants is the protein of milk. The protein of breast milk is more digestible than that of cow's milk"

"In the light of our present knowledge, the chief cause of the difference in the digestibility of the protein of human milk and that of cow's milk lies in the greater proportion of casein in cow's milk"

"It is the formation of large curds which renders the casein of cow's milk so much more difficult of digestion by the infant than that of human milk. If the formation of large casein curds in the stomach can be prevented, the casein of cow's milk is easily digested"¹

In SIMILAC the large casein curds are not formed. The curds formed when the gastric enzymes act upon SIMILAC are small and flocculent, registering zero on the tensiometer, as shown in the illustration, hence more easily digested

The finer the curd the greater the surface area. The greater the surface area the more exposed are the fats, carbohydrates, proteins and salts to the digestive enzymes. Result—a more complete utilization of the food elements

¹Morse and Talbott, Diseases of Nutrition and Infant Feeding, pgs 214, 215

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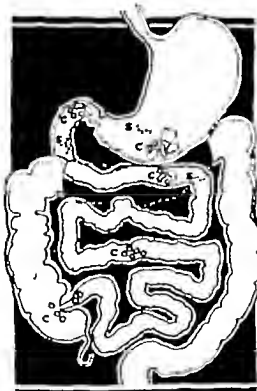
CURD TENSION

- AND INFANT FEEDING -

ITS EFFECT UPON THE ASSIMILATION OF
SALTS



BREAST MILK SIMILAC POWDERED MILK COW'S MILK



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¹ Morse and Talbot: *Diseases of Nutrition and Infant Feeding*, pg. 29.
² Marriott: *Infant Nutrition*, pg. 43

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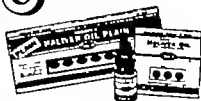


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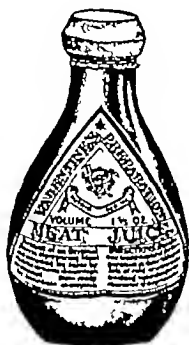
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As a matter of fact, the child's poor appetite failure to gain weight, and irritability may be something more than a behavior problem. It may be rooted in a defect of diet. She may not be getting enough of the factor essential for appetite—Vitamin B!

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Just three heaping teaspoonfuls of Chocolate Vitavose added to a glass of milk, furnish as much Vitamin B as a whole quart of plain milk. The effect upon



the child's appetite is often remarkable.

Within a few weeks she may be eating normally again, show a good gain in weight, and have a happy disposition, instead of being sulky and unmanageable.

For both the child and the mother's sake it is worth trying! The next time you are asked to suggest something that will improve appetite, think of Squibb's Chocolate Vitavose.

And be sure to stress the importance to mothers of serving it regularly with the child's meals or after school every day.

Anorexia in infants often calls for a supplement of Vitamin B. Prescribe either Squibb Vitavose or Dextro-Vitavose. They are milk modifiers which also enrich the baby's diet in Vitamin B.

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Relative Values of Carbohydrates Employed in Infant Feeding

Continued down from 1911

1915

The infant with diarrhea and vomiting is given nothing but tea for from twelve to twenty four hours no longer and then the albumin milk is commenced not over 5 gm ten times a day with 3 per cent. of a maltose-dextrin mixture. The amount of albumin milk is increased by 50 gm. each day until the daily ration totals 300 gm. After the weight has become stationary, carbohydrates can be added up to 5 per cent. of the maltose-dextrin mixture."

Albumin milk is not so uniformly effectual in dysentery as in cholera infantum. Whey seems to act better diluted half and half with oatmeal gruel. After the starvation period he gives 50 gm. of the whey and it increases by 50 gm. daily with equal amounts of oatmeal gruel. As improvement sets in 3 per cent. of a dextrin maltose preparation can be added.—*L. Langstein, Chloera infantum and other severe diarrheas in infants Therap Monatsch V 29 August 1915 Abst J.A.M.A. 65 1314 Oct 7 1916*

1916

Dextrin maltose having a higher absorption tolerance than the other sugars is less likely to cause intestinal disturbances when large amounts of it are given.—*H. R. Missell, A brief résumé of the role of carbohydrates in infant feeding Arch Pediat 33 31-36 Jan. 1916*

1916

In cases of malnutrition and indigestion in infancy the appetite improves rapidly and the stools soon become normal in appearance if the sugars are intelligently prescribed. By this I refer to proper proportions of dextrin and maltose. When there is a tendency to looseness, I have used the preparation known as dextrin maltose for the extra carbohydrates.—*M. Ladd, Further experience with homogenized olive oil mixtures Arch Pediat 33 601-612 July 1916*

1916

For the addition of sugar I usually use dextrin maltose, which does not easily cause fermentation.—*L. L. Meisinger, Use of L'Esseimilch Arch Pediat 33 529-532 July 1916*

1916

In the treatment of marasmus Three per cent of malt sugar should be administered from the first afterwards running up to as high a per cent as the child will take.—*L. T. Royster, A Handbook of Infant Feeding C. V. Mosby Co., St Louis 1916 p 100*

1916

Least irritating of all sugars, and more readily digested and quickly absorbed, is maltose.—*H. Lowenberg, A Practical Treatise on Infant Feeding and Allied Topics F. A. Davis Co. Phila 1916 p 73*

1916

Dextrin maltose is valuable in cases where intestinal disturbances are due to fermentation of milk sugar.

Treatment (of sugar intoxication) consists in eliminating the latter (whey salts) as well as the sugars from the diet temporarily and when the symptoms have subsided, a different sugar in proper proportions should be cautiously added maltose and dextrin are preferable because they are not apt to produce fermentation while milk sugar is prone to set up fever and diarrhea.—*E. E. Graham, Diseases of Children Lea & Febiger Phila 1916 pp 179-201*

1917

For children who are not gaining on a normal formula with a sufficient amount of sugar of milk or children who vomit when sugar of milk is fed, or who are constipated the use of maltose instead of lactose often gives most satisfactory results. This is readily accomplished by substituting for the 4 or 5 per cent. of added sugar of milk an equal amount of dextrin maltose or malted milk which latter gives in addition to the maltose some protein food and an insignificant amount of fat. In many cases children who have failed to gain on other food will immediately show a marked gain as soon as this change is made.—*R. G. Freeman, Elements of Pediatrics Macmillan Co New York 1917 pp 191 and 192*

1917

The carbohydrates most used in infant feeding are the three soluble sugars and starch. The three soluble sugars are lactose, or milk sugar, maltose or malt sugar and saccharose or cane sugar. Maltose is not used in its pure form on account of its cost. The various commercial preparations of maltose are combinations of maltose with various dextrans but as in digestion dextrin is converted into maltose the chemistry is practically the same.

The sugar which is not absorbed is broken down by the bacteria of the intestine into a great variety of fermentation products, among them being lactic, butyric, acetic, and succinic acids.

Another effect of the excessive fermentation which results from a relative excess of carbohydrate in the food, is the formation of an excessive amount of gas. This may cause abdominal distention, and extending backward, it may carry irritating acid products into the stomach, and thus cause vomiting.

Lactose is the sugar most likely to produce acute symptoms. The stools are practically always green and very irritating. Flatulence and colic are less prominent.

The maltose-dextrin preparations rarely produce acute exacerbations.—*C. H. Dunn, The Hygienic and Medical Treatment of Children Southworth Co. Troy New York 1917 pp 423 424 425 428*

1918

The sugars in the foods are milk sugar which is found in mother's milk as well as in cow's milk, cane sugar and malt sugar. Though milk sugar is a natural ingredient of milk it is not well borne by babies when added to their food; they digest cane sugar the ordinary granulated sugar much better; malt sugar is the easiest digested by babies.—*C. G. Leo-Wolf, Nursing in Diseases of Children C. V. Mosby Co. St Louis 1918 p 24.*

1918

Maltose (malt sugar) has the advantage of being very easily digested when part of the sugar given is maltose many children gain more rapidly in weight than when only milk sugar or cane sugar is used.—*L. E. Holt, The Care and Feeding of Children D. Appleton & Co. New York 1918 p 66*

1919

In the administration of protein milk with its large protein content by adding to it sugar which is not easily fermented (dextrin maltose) we produce instead of pathologic fermentation, a condition of putrefaction which changes the acidity of the intestinal contents to alkalinity; the peristalsis is decreased the intestinal contents pass slowly through the large intestines with absorption of fluid and excretion of calcium and magnesium salts. These minerals unite with fatty acids to form the typical fat soap-clay-colored constipated stools characteristic of protein milk feeding and it is at this point that dextrin maltose should be added to the food.

The majority of the cases were kept on protein milk for a period varying from three to four weeks and, in many instances contrary to the usual opinion we were able to keep the children on protein milk plus starch and dextrin maltose, sufficient for their caloric needs for a period of several months, in each instance accompanied by a substantial gain in weight and normal increase in vigor and tissue turgor with comparative freedom from digestive symptoms.—*A. Brown and I. F. MacLachlan, Protein milk powder Canad M J 9 528-537 June 1919*

Continued down to 1934

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The Journal of Pediatrics

VOL 4

MARCH 1934

No 3

Original Communications

OBESITY IN CHILDREN

NORMAN K. NIXON, M.D.
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THE undernourished child has so usurped the attention and worries of the modern mother that his counterpart, the overweight child, usually is ignored unless, perchance, he is held up as an object of envy to that perennial pediatric problem, the child who won't eat. The average physician gives little thought to obesity. If he gives any advice at all to the parents of a fat child, it usually consists of certain admonitions in a very professorial manner and, perhaps, a list of foods or even a diet list. Consequently pediatric literature contains little concerning the subject even though it is one of extreme importance to the internist and of tremendous interest to the laity. Some years ago DuBois said "We do not know why certain persons grow fat perhaps it would be more accurate to say that we do not know why all individuals in this overnourished country do not grow fat. There still are many unknown factors in the pathogenesis of obesity in children."

It is difficult to determine what actually constitutes obesity in a child. So much emphasis is placed on the various height weight tables that individual differences in body build and in constitutional make up often are overlooked. It is stated generally that a child is obese when the excess surpasses 20 per cent. While this holds for the majority one must keep in mind the occasional young 'hnsky' of splendid build and muscular development, who may exceed that limit over the average and yet not be obese. In the minds of the laity and indeed even among pediatricians there exists considerable confusion over this question of when a child is overweight. Just as there is no general rule that will sharply distinguish undernutrition and normal nutrition so there is the same lack of definite standards which separate overnutrition or obesity from normal nutrition. Children often

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are considered well nourished or perhaps pleasingly plump by their parents or family physician, and yet may be obviously obese to the casual observer

A brief review of fat metabolism in normal individuals may be helpful in evaluating some of the chemical and metabolic studies on obesity. The fats consist of a combination of fatty acids and glycerin, the triglycerides of palmitic, stearic and oleic acid. To be absorbed from the intestinal tract, fats first must be saponified by the action of the pancreatic juice, resulting in a separation of the fatty acids from the glycerin. After passage through the intestinal wall, these split portions are reunited, but in a different form, so as to resemble the natural fat of the individual. The fats are carried to the blood stream through an indirect route by means of the lacteals and the thoracic duct. The destination of the blood fat is twofold—the fat depots including the retroperitoneal and subcutaneous tissues where it is stored, and the liver where it undergoes certain chemical changes which allow for subsequent use as fuel.

It has been proved that carbohydrates are capable of producing fats directly, but a direct fat production from protein is not certain although the latter can be split into a carbohydrate which may lead to fat formation. Stored fat represents approximately one-sixth of one's body weight. During starvation most of the energy requirement of the body comes from the utilization of this stored fat, which is carried by the blood stream to the liver and there metabolized. When the diet contains ample carbohydrate and protein, little of the fat intake is burned, most of it being stored. The statement, "fats burn only in the fire of carbohydrate," is one of the few facts of physiology which the medical student rarely forgets. For the combustion of two molecules of fatty acid, one molecule of dextrose is necessary.

The make-up of the diet is important for body growth and maintenance, supply of energy involved in muscular work, and the production of body heat. Fat is not absolutely necessary in the diet for, as a source of energy, it may be replaced by carbohydrate or protein. The protein requirements in infancy and childhood necessary for the maintenance of life and the building of body tissue vary from 2 to 4 grams per kilogram of body weight. The energy for work and heat production results from the oxidation within the body of the carbon and hydrogen of fats, carbohydrates, and amino acids. If the energy used is less than is supplied by the food, the body usually gains weight due to fat storage, if the energy output is greater than the food supplies, the body loses weight due to the utilization of the available store houses.

However, the caloric intake and energy expense do not always account for the weight curve of human beings. Neuman² in 1902 experimented on himself for a steady period of two years during which

time he maintained his normal weight and well being on diets equivalent to 1,750, 2,200, and 2,400 calories. Grafe and Koch⁸ studied a fourteen year-old boy weighing 265 kilograms (140 centimeters in height) who was given diets consisting of 88 calories and 51 calories per kilogram of body weight for approximately two weeks each without any change in his weight curve. When the diet was further reduced to 40 calories per kilogram, less than half of the original diet of 88 calories, the boy lost only 0.5 kilogram during another two week period.

Numerous other experiments have been reported demonstrating the constancy with which most children, just as most adults, maintain their normal weight and growth curves despite the fact that the food intake fluctuates, and their physical activity varies from day to day. When a child loses weight as a result of illness, he quickly regains that loss when he begins to eat again and reaches approximately the same basic weight as before. This weight equilibrium is dependent upon a sensitive mechanism of regulation, the disturbance of which causes some children to be fat and others to be lean.

Barker⁴ pointed out that the term "obesity" is derived from the Latin word *obesus* meaning "that has eaten itself fat, stout, plump," which derivation suggests that for those who first introduced it in the seventeenth century the word designated a condition actually dependent on eating too much. Today there are many who still believe that there is only one basic cause of obesity—overeating. The common practice, however, is to divide obese individuals into two groups: the exogenous as exemplified by the commonly cited Falstaff and the endogenous type, as represented by the fat boy of Dickens' *Pickwick Papers*.

Newburgh⁵ and the champions of exogenous obesity argued that in obese patients the energy expended is less than the caloric intake, such laziness and gluttony resulting in a positive energy balance. They further pointed out that if the potential energy intake be reduced below the output the obese patient will lose weight. But Silver and Bauer⁶ were not convinced by this interpretation which does not explain why the obese child actually consumes more food than is required to maintain his normal weight or why his energy output is usually decreased.

Obviously, there is some inherent tendency, be it constitutional, metabolic, endocrine or neural in origin, which must be offered in explanation of why children of the same family, living in the same environment, and eating the same food will differ in this fat regulating mechanism. Recently I have been observing very interesting twins four years of age, one of whom (the boy) is of normal weight, height, and development, while his sister, when first examined, weighed 61½ pounds, being 26 pounds heavier than her twin brother.

and correspondingly larger in body build. In this family there is a definite tendency to obesity, particularly on the mother's side. Bauer⁶ reports a familial incidence of obesity in some 88 per cent of his cases, and emphasizes the constitutional make-up of the individual, stressing the etiologic importance of the congenital and hereditary nature of the obese state. Von Noorden⁷ found 70 per cent of his obese patients came from families in which obesity prevailed. In approximately 75 per cent of the obese children we have been studying, there is a definite family history of obesity.

Various races and tribes tend to be either fat or thin, and breeders of live stock can testify that certain breeds cannot be fattened even though they are fed and treated the same as those which are made to gain weight rapidly. Danforth⁸ of Stanford reported a strain of yellow mice with a definite tendency to obesity at maturity. Females were more often affected than males, and the excess weight often was three times as great as that of normal adults of other strains. On starvation diets, these fat mice could be reduced easily. Danforth pointed out the interesting observation that this strain of yellow mice had fewer litters and that the period of fecundity was much shorter than the average for other strains.

Various disorders of metabolism, both qualitative and quantitative, have been suggested in an attempt to explain obesity. The theory of a qualitative abnormality is chiefly of German origin. Von Bergmann of Berlin introduced the terms "lipophilia" and "lipomatosis." A probable localized and independent disposition of certain tissues to obesity is illustrated by reported cases¹⁰ of autogenous grafts transplanted from the abdominal wall to the back of the hand. In these instances definite unilateral obesity has been observed, demarcated by the limits of the skin graft on the dorsum of the hand which rarely becomes fat. The lipophilia or tendency to accumulate fat of the transplanted abdominal wall apparently is retained even though severed from the original blood and nerve supply.

Wang, Strouse, and Saunders¹¹ demonstrated that on a high fat diet, the respiratory quotient, or the ratio between the volume of carbon dioxide expired and the volume of oxygen inspired in a given time, was constantly higher in obese subjects, suggesting that in obesity, fat is less easily oxidized or deposited more readily. This result may be explained equally well, as Wilder¹² suggested, on the theory that the larger stores of glycogen, undoubtedly present in the overweight individual, are utilized when the carbohydrate intake is low. Both processes, sugar burning and fat storage, raise the respiratory quotient.

Some have wondered if obesity is a qualitative anomaly of metabolism more or less analogous to diabetes mellitus. Obesity frequently

accompanies or is a precursor of both mild and severe cases of diabetes and may therefore be due to increased transformation of carbohydrate into fat

The theories of a quantitative disorder in the metabolism of the obese individual are based on a marked reduction in the expenditure of energy. Von Noorden⁷ first observed that the obese subject produces less than the normal heat when calculated on the basis of kilograms of weight. But Rubner¹² in his experiment on two brothers, one fat and the other thin, demonstrated that the basal metabolism per square meter of body surface is the same in the two types of individual. Grafe and Grabam¹⁴ in a well controlled experiment observed a 40 per cent increase in the basal metabolic rate without gain in weight in a dog fed twice the minimum requirement during a fifty-nine-day period. Grafe assumed that amounts of food over the actual need of the normal individual tend to increase metabolism sufficiently to burn up the excess. Therefore, the failure of the obese individual to respond normally to this stimulus is the reason for his obesity, according to Grafe's theory.

Strang and Evans¹⁵ have emphasized recently that the basal metabolism in obesity is even increased rather than decreased if the probable mass of muscle or active tissue is made the basis for calculating the energy metabolism rather than the patient's actual weight. This is borne out in Baner's¹⁶ notation that Heinbecker found a distinct increase in the basal metabolism of Eskimos who are characteristically obese. Strouse¹⁷ and his coworkers have stated that no consistent relation exists between constitutional obesity and basal metabolism. They conclude that 'neither excessive undernutrition nor excessive overweight is associated with a constant change in basal metabolism.'

Topper and Mulier¹⁸ working with seventy overweight but otherwise normal, children concluded that the basal metabolism is usually normal in obese children with a tendency toward a high normal rate. They found an apparent association between the prepuberty period and an increased basal rate due, perhaps, to the increase in growth, increased activity of the endocrine glands, and the awakening of sexual life. These investigators used the Pirquet and Talbot standards and did not take into consideration the patient's body weight. Dr Howard West's determinations of the basal metabolic rate in a considerable number of our obese patients were not conclusive except to agree with Anne Topper and others that the basal rate in obese children is usually within normal limits, even approaching a high normal in many instances. Relatively few had rates below minus ten which is considered the lower limit of normal. One encounters many difficulties in obtaining a correct basal rate in most children with the apparatus and methods used in office practice. The child's hunger, his apprehension and frequent behavior difficulties require much time, effort, and

patience to overcome. With the small portable machine, accurate determinations of the basal metabolic rate are not obtainable in the average child under nine or ten years of age. The metabolic chamber seems indispensable in careful studies of basal metabolism, but its extensive equipment and the necessity for trained personnel precludes its use in most hospitals and clinics.

Plaut¹⁰ in 1922 reported a very definite lowering of the specific dynamic action of food in obese individuals and a very marked rise in those persons with so-called constitutional thinness. By specific dynamic action of a foodstuff is meant the increase in the heat production of the organism following the ingestion of that foodstuff. Wang, Strouse and Saunders¹¹ demonstrated that protein showed a very slight specific dynamic action in obese people while normal persons and those extremely thin showed a very high specific dynamic action of protein. No significant changes from the normal were observed with the specific dynamic action of carbohydrate and fat. However, this lessening of the specific dynamic action of protein probably would have a relatively small effect on the total metabolism of the fat child and can hardly be considered a primary cause of obesity.

Considering the theories on the rôle of hormones in the regulation of body weight, we also find confusion. Englebach,²⁰ for instance, classified every case of endogenous obesity in children on the basis of clinical characteristics, often not clear-cut, and from inference, grouped them under thyrogenic, pituitary and other types. These endocrine groups, however, are not definite and are subject to much speculation.

Those obesities of infancy and childhood attributed to diminished thyroid activity are less common than those due to the supposed involvement of the pituitary alone, or in conjunction with thyroid deficiency. The obesities of infants and young children are more apt to be thyrogenous in origin, in contrast to the more commonly assumed pituitary origin of obesities in older children and adolescents. The retardation of growth, delayed appearance of the epiphyses, delayed dentition, lack of normal mental development, the pale, dry and coarse skin and other characteristics of cretinism are too well known to warrant more than mentioning. Juvenile hypothyroidism and myxedema are similar to the adult picture.

Obesity of older children associated with infantile genitals has been considered to be due to alterations of the hypophysis. Frohlich's syndrome or adiposogenital dystrophy is characterized clinically by a distribution of fat with the lower abdomen, hips, and thighs chiefly involved. Enlargement of the breasts is often pronounced. Widely separated upper incisors are said to be characteristic although they do not occur in all cases, and the condition may be present in persons with no signs of hypopituitarism. The genitals are strikingly small and undeveloped, so much so that sometimes they are buried

in the fatty tissues around them. Many transitory stages exist between the Frölich type and the more usual forms of generalized obesity so that the characteristic example is rare.

An insufficiency of the posterior lobe of the hypophysis is too often thought to be the etiological factor in the production of obesity. Cushing²¹ experimentally produced increased fat deposits in animals by removing the posterior lobe, explaining the results on a disturbance of carbohydrate metabolism. Other investigators have attributed such obesity to lesions of the nervous system in the region of the hypophysis. In the present state of our knowledge, with the presence of a normal sella turcica and with the absence of nervous symptoms produced by involvement of the infundibular region, the pituitary origin of obesity can be only a hypothesis.

That the existence of an obesity of pituitary origin is far from an established fact emphasizes the uncertainty of action of pituitary extract in the treatment of fat children. There is considerable variation of opinion regarding the treatment of pituitary obesity. Some years ago Cushing²¹ stated that laboratory animals usually lose weight when given protracted treatment with posterior lobe extract. Englebach²² broadened that statement to include all human beings suffering from obesity thought to be due to pituitary dysfunction and advised the intramuscular administration in all such cases of pituitrin, the posterior lobe hormone together with the pituitary sex hormone of the anterior lobe. Oral administration of desiccated pituitary substance was advised in conjunction with the preparations given intramuscularly and those cases which had an additional thyroid involvement were given desiccated thyroid. Carlson,²³ however, emphasized the uselessness of oral administration of all glandular products available at the present time, with the exception of desiccated thyroid.

Englebach firmly believed that endogenous obesity does not react to diet, exercise, or hydrotherapy and thought that in at least the earlier cases of short duration decided effect upon the excess weight is accomplished by replacement therapy without the addition of diet or other weight reducing procedures. However it is well to emphasize that his prescribed treatment nearly always consisted of a low caloric diet, exercise and the restriction of fluids in addition to replacement therapy.

This plan was followed in treating obese children in the out patient department of the Children's Hospital for a period of approximately two years. Surgical pituitrin was given intramuscularly twice weekly in amounts necessary to produce the so-called intestinal reaction causing abdominal cramps and colic followed within half an hour by defecation. Antnitrin and thyroid were given when indicated. In addition these fat children were placed on a diet of approximately 850 calories, made up of protein, 60 grams, carbohydrates, 110 grams, and

fat, 19 grams, and adequate vitamins and minerals. The majority of the fat children thus treated lost weight and for the most part the results were satisfactory. A similar satisfactory result was obtained in an occasional child who was treated with only diet and exercise. This, together with the failure to lose weight of some obese children who received replacement therapy regularly over long periods, but who on subsequent observation in the hospital or convalescent home were proved to be eating far more food than allowed on the prescribed diet, made us skeptical of the actual benefits derived from the use of the endocrine products. The use of pituitrin was discontinued, and for the past two years all cases of obesity have been treated with the same 850 calorie diet and supervised exercise in a reducing class sponsored by the department of physiotherapy. Desiccated thyroid has been given to the occasional child who, after reaching a level, could apparently lose no more on the diet and exercise regime alone. Our results appear to be just as satisfactory as in those cases given endocrine preparations.

The frequency with which diabetes is preceded by obesity suggests that the pancreas may have something to do with the storage of fat. In the past few years the use of insulin in undernourished individuals has been advocated as a weight-gaining measure. However, the excellent results reported are probably due to the hypoglycemic effect of the insulin and the subsequent hunger and increased appetite rather than to any direct effect on fat metabolism.

The rôle of the remaining glands of internal secretion is still more doubtful. Thus one is forced to agree with Wilder¹² that "when all is said on the score of the endocrine glands, it leaves one with the impression that their rôle in the production of obesity has been astonishingly overestimated."

Recently evidence has been accumulating suggesting that the nervous system plays a more important rôle in fat regulation than the endocrine glands. Such affections of the brain as tumors, epidemic encephalitis, hydrocephalus, and chronic meningitis sometimes are accompanied by a sudden increase in body weight. These patients have the usual symptoms of the brain lesion which usually occurs in the floor of the third ventricle or in the infundibular region where there are visceral nuclei regulating the metabolism of fats, carbohydrates and water. In hydrocephalus obesity probably only occurs in those instances in which there is a dilatation of the third ventricle resulting from a closure of the aqueduct of Sylvius, connecting the third and fourth ventricles, the communication between the lateral and third ventricles remaining open.

Leschke²³ recently reported a series of 149 autopsies on cases of adiposogenital dystrophy. He reported only twenty-one in which the

pituitary body alone seemed to be involved. In the remaining 128 cases there was definite pathologic evidence of injury to the neighborhood structures in the diencephalon with no apparent change in the pituitary body. Philip Smith⁴ has demonstrated in animals that removal of the hypophysis without injury of the surrounding brain tissue will not cause obesity. His experiments further demonstrated that when the diencephalon definitely is injured obesity usually results regardless of whether or not the hypophysis is damaged.

Many observers have noted the occurrence of obesity after typhoid fever and other infectious diseases. The abrupt development of obesity after an acute infection involving the central nervous system points to the possibility of inflammatory changes in the region of the pituitary body and the visceral nuclei. Raab²² reported an example of obesity following post-vaccinal encephalitis. Adiposity often follows lethargic encephalitis while the pathology of this disease involves chiefly the mesencephalon and diencephalon, the hypophysis rarely being affected. Moncrieff²⁶ has recently reported two cases of marked obesity occurring after the acute stage of chorea. Coburn²⁷ mentioned obesity following chorea in seven of his carefully studied 3 000 rheumatic patients and states that "this striking development of adiposity is perhaps an objective indication of cerebral changes, possibly in the region of the hypophysis."

Such symptoms as polydipsia and polyuria, unusual lethargy or disturbance of heat regulation frequently are associated with obesity following injuries or pathologic changes in the diencephalon. Wilder²⁸ was of the opinion that "the theory of abnormal central irritability is more probable than any of the explanations of obesity based on postulations of endocrine disturbance or abnormal economy of energy."

TREATMENT

The prevention of obesity would be given more attention if people realized how much easier it is to avoid gaining an excess of weight than it is to reduce the weight once it has been put on. The modern mother in her anxiety to see her child grow and develop normally often is responsible for his gradual acquisition of a large appetite. She instinctively feeds her child all she possibly can. Such an attitude may result in the child's acquiring a permanent habit of eating more than his body requires. Eating is one of the favorite indoor sports of America. It is encouraged by the art of cooking which has as its sole object the endeavor to get us to eat more than we should. Previous to the present economic collapse overeating had become a habit with millions of adults as well as children, yet most of us escaped adiposity.

Should obesity in children be ignored? Is the reduction in weight of the obese child worth all this effort? We are not certain whether

all the degenerative changes that accompany adiposity in the adult occur in childhood. But we do know that obese children are poorer surgical risks, that they are more prone to develop pneumonia and pulmonary complications, and that diabetes is a potentiality to be considered. Faulty posture, usually a lumbar lordosis, and various orthopedic abnormalities of the feet are aggravated or initiated by obesity. Fat children are the victims of continuous teasing, which in some is apt to initiate a feeling of inferiority resulting in serious behavior problems. The esthetic value of a slim body, of prime importance to the young co-ed, is not the least consequential of all the reasons for maintaining normal weight in a child.

The diet is the all-important factor in the treatment of obesity in children. It should be sufficiently low in calories to insure a negative energy balance. Enough protein should be prescribed to assure a nitrogen balance, to protect the body proteins, and to allow for normal growth and development. The diet should include an ample supply of the vitamins as well as mineral salts, especially calcium and iron. Foods which allay hunger and give the greatest satisfaction are most desirable. Meat, for instance, sticks to the ribs the longest of the protein foods, according to McLester²⁸. He further points out that hard-boiled eggs have a higher satiety value than soft-boiled eggs and potatoes are preferable to bread for the same reason.

Various types of diets have been suggested, but in the final analysis, providing sufficient protein is consumed to assure a nitrogen balance, it matters little just how the diet is made up, the principle of all obesity diets being a reduction of the total caloric intake to such a level that the fat stored in the body will be called upon to make up the daily energy requirements. The cooperation of the patient and both parents is most essential in seeing that the obese child adheres to the dietary regime.

Veeder²⁹ maintained that the rapid growth which takes place at the pre-adolescent and early adolescent period tends automatically to correct the obesity, if the child's dietary can be controlled. He favored maintenance of the obese child's weight permitting the patient to grow into it, so to speak, rather than attempting a marked reduction of the weight.

One should explain to the parents beforehand that the sudden losses or gains usually are due to changes in the water content of the body, not change in the amount of fatty tissue. The loss of several pounds during a strenuous afternoon of play on a hot summer day is usually regained within a day or two through increased water intake. The studies of Friese and Jahr³⁰ have proved conclusively that fat children show no greater tendency to retain water than do normal children and that the restriction of the fluid intake is of no importance in the treatment of obesity.

As an adjuvant of dietotherapy, exercise undoubtedly is of great importance. Calisthenics, walking, tennis, roller skating, swimming, or any form of muscular activity available to the child should be encouraged. The cooperation of our physiotherapy department in maintaining the reducing class has been very helpful. The obese child characteristically is lazy and it is sometimes doubtful whether he is carrying out his prescribed exercises at home, in the reducing class he is put through his paces on at least two days a week. But one should remember that muscular exercise increases appetite and the benefits of increased caloric expenditure resulting from the exercise may be cancelled by an increased caloric intake not called for on the dietary plan.

Massage seems as useless in treating the fat child as it is in the adult, although it perhaps increases the sense of well being. Barker⁴ remarked that "massage does nothing toward the removal of fat in the patient though it may do so for the masseur."

The medicinal treatment of obesity seems of little importance even though the use of various endocrine preparations has been all too common. Every obese child can be made to lose weight on diet and exercise alone, provided there is the proper cooperation between the child, his parents and the doctor. Occasionally, the addition of desiccated thyroid by mouth is advantageous as an adjunct to diet and exercise in the child who, on the usual regime has established a level and is unable to further reduce his weight without the catabolic effect of the thyroid. This is a drug to be respected however and should not be used indiscriminately in every case of obesity. When thyroid products are prescribed the patient must be observed frequently for symptoms of thyroid intoxication.

While others have reported the successful use of hypophyseal preparations in the treatment of dystrophia adiposogenitalis and other forms of obesity in children their results would appear more convincing if the endocrine replacement therapy were the sole method of approach. However, increased muscular activity and a lowered caloric intake are the all important factors in any successful treatment of obesity regardless of its etiology. If the overweight child can be reduced to his normal on diet and exercise alone with perhaps occasionally the use of small doses of thyroid extract by mouth it would seem unwise to resort to the fear, discomfort, pain and expense of injecting pituitary or other glandular preparations.

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1136 WEST SIXTH STREET

NONSPECIFIC INFECTIOUS GRANULOMA AND CARCINOID OF THE APPENDIX

REPORT OF A CASE

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NONSPECIFIC infectious granuloma of the appendix is very infrequent in adults and extremely rare in children. In a fairly careful review of the literature only fourteen cases were found in which a granuloma involved the appendix. A summary of these cases is shown in Table I.

TABLE I

AUTHOR	AGE	SEX	TREATMENT	RESULT
Regling, ¹ 1902	69 yr	M	Tumor appendix, portion of ileum and cecum removed	Death
Gangitano, ² 1909	32 yr	F	Tumor and appendix removed	Recovery
Goto, ³ 1912	52 yr	M	Tumor and appendix removed.	Recovery
	59 yr	M	Tumor and appendix removed	Recovery
Läwen, ⁴ 1914	51 yr	F	Tumor, appendix portion of ileum and cecum removed. Lateral anastomosis of ileum to transverse colon	Recovery
Tietze, ⁵ 1917	27 yr	M	Drained	Recovery
Körte, ⁶ 1921	33 yr	Unstated	Tumor appendix portion of ileum and cecum removed.	Recovery
	38 yr	Unstated	Appendix removed. Tumor not removed.	Recovery
	50 yr	Unstated	Tumor portion of ileum and cecum removed. Lateral anastomosis of ileum to cecum. Appendix not isolated	Recovery
Gunn and Howard, ⁷ 1931	41 yr	M	Tumor and appendix removed	Recovery
Eggers, ⁸ 1933	64 yr	M	Ileocolostomy. Tumor not removed. X ray therapy	Recovery
Gowen and Van Alstyne, ⁹ 1933	22 yr	M	Tumor and appendix removed	Recovery
Janssen, ¹⁰ 1933	21 yr	F	Appendix removed. Tumor not removed.	Recovery
Morris, ¹¹ 1933	23 yr	M	Tumor and appendix removed. Colocolostomy about the obstruction of transverse colon	Recovery

In this group of fourteen cases there was no record found of any in the age of childhood the youngest patient being a woman, twenty one years old—the case reported by Janssen.¹⁰

Carcinoid tumors in children, on the other hand, are well known, but no record could be found of a carcinoid of the appendix associated with

From the Surgical Service of Dr. A. H. Montgomery at the Children's Memorial Hospital.

a granuloma The following case is of interest because the granuloma and carcinoid tumors were found in the appendix of a girl, aged eleven years

H. M., a girl aged eleven years, was admitted to the Children's Memorial Hospital, Dec. 7, 1932, complaining of pain in the abdomen, vomiting, and fever The pain associated with vomiting began nine days before admission and, at the onset, was generalized throughout the abdomen. The temperature before admission was as high as 101.2° F The patient was given milk of magnesia on the first day of her illness, and her bowels moved once after this Four days after the onset her condi



Fig 1—Granuloma in the omentum showing necrosis and granulation tissue $\times 200$

tion improved so that she attended school for one half day, but shortly after the abdominal pain gradually became more severe and settled in the right part of her abdomen.

Her previous history was relatively unimportant.

Physical examination was negative except for the abdominal findings. There was tenderness over McBurney's point and just above it The right lower abdominal wall was rigid. No mass was felt on rectal examination. Blood examination revealed 18,800 leucocytes, with 88 per cent polymorphonuclear forms The urine examination showed nothing abnormal, and no gonococci were found in the vaginal smears The temperature was 101.9° F, pulse 100, and respiration 24.

A diagnosis of acute appendicitis was made, and four hours after admission the patient was operated upon under nitrous oxide anesthesia. On opening the abdomen through a McBurney's incision a large, firm, nodular mass 10 cm in diameter was

encountered which surrounded the distal and middle portions of the appendix. This mass was attached to the anterior and lateral abdominal walls and to the omentum. The proximal portion of the appendix which was not involved in this mass, was ligated at the base and amputated. The stump was cauterized but not invaginated because of technical difficulties. The mass was freed with some difficulty, and some capillary hemorrhage, which was controlled by warm packs, ensued. A definite small amount of pus was encountered during the operation. Two cigarette drainage tubes were inserted down to the region from which the mass was removed and the incision closed. The dressings were changed once during the night following the operation because of hemorrhage. The day following the operation the patient developed marked abdominal pain, distention and rigidity a temperature of 106 and died with signs of acute peritonitis.



Fig. 2.—Granuloma showing necrosis of omentum with leukocytes and fibroblasts $\times 1000$

A necropsy (limited to the trunk) revealed a bilateral terminal hypostatic broncho pneumonia, acute generalized fibrinopurulent peritonitis (*Streptococcus viridans*) and a small granuloma in the omentum at the site of operation. The granulomatous tissue measured 2 cm. \times 2 cm. and was apparently a portion of the mass which was overlooked at the time of operation.

The mass removed at operation measured 10 cm. \times 5.5 cm. \times 3 cm. About one half of its surface consisted of a sharply defined reddish brown portion, the central part of which was friable and easily torn. The rest of the surface was made up of light brown to yellow nodules of omentum in the crevices of which were injected blood vessels. On the broad flat surface made by sectioning longitudinally, three-fourths of the specimen was light gray to brown and streaked with yellow nodules. The

appendix, which was retained within the middle and anterior portion of the mass of tissue, measured 10 mm. in diameter. The entire central portion of this appendix was light brown to yellow, its periphery pearly gray. In the middle of the wall of the appendix, there was a discrete, gray nodule measuring 2 mm in diameter. This was all encased in a reddish brown, soft, edematous mass of tissue which was evidently friable granulation tissue and omentum.

Microscopic examination of the tissue showed the mucosa of the appendix was everywhere intact. In the submucosa were isolated neutrophilic polymorphonuclear leucocytes and active hyperplasia of the germinating follicles of the lymphoid stroma.

The tunica muscularis and serosa, however, were markedly distended with serum and a huge infiltration of polymorphonuclear leucocytes in various stages of de-



Fig 3—Carcinoid cells in strands and clumps growing in the appendix $\times 200$

generation. In places, clumps of these leucocytes were present as in suppuration. The fatty areolar tissue of the omentum was intimately fused around the entire appendix and so diffusely infiltrated with this inflammatory exudate that it was difficult to decide as to which portion was appendix or omentum (Figs 1 and 2). Isolated foreign body giant cells were present in the serosa and in the omentum.

In the peripheral portions of the submucosa of the appendix, there were clumps and strands of cells with large, oval to round nuclei (Figs. 3 and 4). The nuclear chromatin was present as coarse granules distributed throughout the nucleus but possibly more abundant near the periphery. No definite mitotic figures were present. The nuclei were about two times the size of those of the lymphoid tissue of the submucosa. Where these large nuclei occurred in single strands which ramified through the submucosa, they were enmeshed in a fibroblastic reticulum.

COMMENT

It seems unnecessary to discuss the different features of nonspecific granuloma in detail, because they have been enumerated admirably by Andrews¹² Birt and Fischer,¹³ Braun¹⁴ Coffen,¹⁵ Eisenberg,¹⁶ Fñth,¹⁷ Gordon,¹⁸ Goto,³ Grasei,¹⁹ Jaffe,²⁰ Koch,¹ Körte⁶ Lejars,²² Mock,²³ Monsarrat,⁴ Morian,²⁵ Movinhan,²⁶ Prima²⁷ Tietze⁵ Wilensky and Moschowitz,²⁴ and others. A few additional comments are sufficient.

As far back as 1898 Gassanbaur reported a case of an inflammatory tumor of a diverticulum which he at first thought was a carcinoma, but



Fig. 4.—Carcinoid showing nuclei and cytoplasm with fibroblastic reticulum. X1000.

which later proved to be a nonspecific infectious granuloma. In 1908, Heinrich Braun¹⁴ reported his classic collection of inflammatory tumors of the bowel which are now designated as nonspecific infectious granuloma. There were, however, a number of cases reported before Braun's contribution.

Nonspecific infectious granuloma occurs in children in regions other than the appendix. Körte⁶ reported a case of granuloma of the ileum in a child aged eight years and Prima²⁷ reported a case with a granuloma of the back in a child aged three months, occurring probably as a result of a puncture of the amnion. Granulomata occur in other regions than the gastrointestinal tract as shown by Prima's²⁷ case involving the back,

numerous cases that have been reported involving the female genital organs, and the case reported by Hufnagl²⁹ involving the abdominal muscles and bladder Korte⁹ stated that the majority of these lesions are in the colon Some of the granulomata follow appendectomy, the subsequent involvement often being in the cecum or ileum, or both In 107 cases of granulomata of the abdominal organs, there were eight that were definitely stated to have followed appendectomy

The granulomatous tumor consists of a hyperplastic mass, often occurring at the site of some preceding lesion, as a gastric ulcer, appendicitis, bowel ulcer, or of a foreign body It represents a destructive combined with a reparative process Necrosis occurs accompanied by a productive proliferation composed of round cell infiltration, leucocytes, fibroblasts, connective tissue stroma, new blood vessels, giant-cells, and often mast-cells Finally a definite, tumorlike mass, a granuloma, forms which may become the size of a grapefruit

The symptoms are those of local infection, bowel obstruction, and constitutional reactions Pain, tenderness, rigidity, and a mass are often present locally Intestinal obstruction occurs if the tumor encroaches on the bowel lumen The constitutional reactions include fever, leucocytosis, and loss of weight

The diagnosis is rarely made except at operation or necropsy These cases have often been diagnosed as carcinoma, syphilis, or hyperplastic tuberculosis of the bowel More rarely they have been confused with amebic disease, actinomycosis, and bilharziasis (Tietze⁵)

A diagnosis of carcinoma has frequently been made and a fatal prognosis given, and yet the process has terminated in a complete recovery In a number of cases reported, the granulomata disappeared spontaneously Recurrences after apparently complete removal have been noted in many patients

The treatment of these cases is essentially surgical Often simple exposure of the mass, drainage, or a sidetracking operation of the intestine results in a disappearance of the tumor Local removal, if possible, is advisable except when pus is present, in which case drainage is advisable If bowel obstruction is present enterostomy or entero enterostomy is recommended

Carcinoid tumors were first separated from carcinomas by Lubarsch in 1888 Oberndorfer³⁰ proposed the name "carcinoid" in 1907 They have been ably described by a number of authors^{10 31 32 33, 34 35} These tumors have been referred to as "chromaffin" because they stain well with chrome salts They have also been known as "argentaffin" tumors since Gosset and Masson³¹ found that the granules of their cells reduce ammoniacal solutions of silver

The tumors according to McGlannan and McCleary³⁵ and several other observers originate from certain *chromaffin* cells found at the base of

Lieberkühn's crypts It has been thought that they arise from sympathetic nerve tissue but Masson²¹ opposed this view He believed they resulted from proliferation of intranervous argentaffin cells of the neurocrine type They were at one time thought to be pancreatic rests (Saltzkow²⁶) Also, they have been considered as malformations Bunting's²⁷ view was that they were analogous to Krompecher's basal cell carcinomas of the skin According to Forbus²² they occur in 0.4 per cent of appendices removed at operation Masson²¹ found fifty carcinoid tumors in 1,200 appendices which he examined.

Carcinoids in general are comparatively small tumors They are rarely more than a centimeter in diameter (Raiford²⁴) and may be so small as to be invisible to the naked eye In regard to malignancy, it seems that they are comparatively benign as Stewart and Taylor²⁸ in 1926, in an extensive review of the literature, found only eighteen cases of carcinoid tumors with metastases In those cases, metastases were found in the regional lymph nodes, mesentery, liver, peritoneum and pleura

Because of their small size, it is doubtful whether these tumors could cause symptoms referable to the appendix unless they should obstruct the lumen with a resulting inflammatory reaction It might be suggested that carcinoid tumors may be more commonly the primary factor in appendicitis than is generally supposed If complete sections were made of all appendices removed more carcinoids would probably be found because many are microscopic in size

Their treatment, of course, is the usual appendectomy

The patient reported here died from a generalized peritonitis probably as a result of overlooking a small portion of the infected granuloma attached to the omentum However another possibility is that the fatal peritonitis resulted from the free pus encountered at the time of operation Still another possibility is that the peritonitis had already begun before the time of operation This last supposition is supported by the fact that there was evidence of a severe infection during the nine days preceding the operation Mock²³ stated that as a rule a granuloma soon becomes and remains sterile

The probable sequence of events in this patient is as follows the carcinoid growing in the wall of the appendix finally produced an obstruction of the lumen with resulting inflammation distal to that point a rupture occurred soon after with localization of the infection and ultimately a granuloma developed and grew into the omentum

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creased food consumption Working with pigs they found that "runts" made better gains with insulin than without, but healthy animals gained equally well in the long run with or without insulin The food consumption was carefully measured, showing an increased intake with insulin

Insulin, as an appetizer, has not been used much in children Pitfield,¹⁰ who was the first to employ it in infants, gave it to two babies four and five months of age respectively, who were suffering from malnutrition, with encouraging results Subsequently Marriott¹¹ used it with good effect, together with glucose parenterally, in athreptic infants He employed it only in extreme cases Fischer and Rogatz¹² used insulin in twenty-seven infants ranging from three weeks to thirteen months of age, and suffering from various degrees of malnutrition They considered its use beneficial and even life saving in some cases Tisdall et al¹³ also gave insulin to infants under one year, most of whom were suffering from malnutrition They cast a discordant note into the tune of insulin efficacy in malnutrition by reminding that since marasmic infants have a lower blood sugar than normal infants, insulin may be dangerous at times Moreover, since they metabolize glucose at a faster rate than normal infants, the administration of insulin is unnecessary Their contention has subsequently been given support by the work of Wilson, Levine and Gottschall,¹⁴ who showed that there was no fundamental difference in carbohydrate metabolism between normal and marasmic infants, that marasmic infants suffered no demonstrable defect of carbohydrate metabolism They found that the amount of carbohydrate burned by either normal or marasmic infants was essentially the same whether insulin was or was not administered The work of Barbour¹⁵ is one of the few instances of the administration of insulin in older children to increase their weight He used three units three times a day before meals in children under two years, and five units three times a day in older children He found consistent improvement in weight and well-being, with best results in those cases suffering from the greatest degree of malnutrition He could discern no untoward results

In an attempt to evaluate the efficacy of insulin in older children and to determine the optimum dosage, the following studies were undertaken One group of five boys and another of six boys, ranging from eleven to fourteen years of age, were observed They were all underweight from 4 to 20 per cent below the accepted standards for their height and age

FIRST SERIES

Five boys, wards of the Brooklyn Hebrew Orphan Asylum, were chosen as subjects The advantages of using institutional subjects are

obvious with respect to cooperation from the authorities in charge and from the children themselves. Diets are more easily and more accurately controlled. The growth curves of the children for previous years are available. Moreover, the children can be compared with the hundreds of other children not being studied, who act as controls. No physical abnormalities could be detected in the subjects after careful medical examination. They were active and cheerful. In short, they typified the youngster whom anxious mothers usually bring to the physician with the complaint of underweight and poor appetite.

Insulin injections were given twice daily fifteen to thirty minutes before meals. In the morning they were given by the nurse in charge, in the afternoon by either one of us. The initial dose was three units twice a day, and was increased in two days to five units twice daily. This dose of five units twice a day was then given for two weeks. At the end of two weeks the dose was slowly increased to eight units twice a day, taking one week to accomplish this. For the fourth week the dose was increased in a similar way to thirteen units twice a day. During the fifth week the dose was fifteen units twice a day. The latter dose was also given during the sixth and seventh weeks of insulin administration, but here the injections were given one hour before meals in order to produce a maximum degree of hypoglycemia by the time food was taken. At this time the gastric hypermotility due to hypoglycemia should be manifested.

The diets which the subjects received were carefully supervised with respect to quantity, so that as much food was served as an augmented appetite might require. The fare was of the usual type, the only deviation from routine being the candy given in the event of hypoglycemia. Care was taken that the candy should not be eaten until after mealtimes unless symptoms supervened.

Several menus served the children at the institution where this work was carried out are here set down. They have been picked at random.

Breakfast	Oatmeal bread, butter, cocoa, sugar
Lunch	Hamburger loaf, mashed potatoes, peas, carrots, apples, bread.
Dinner	Baked beans, bread, butter, chocolate pudding, milk
Breakfast	Wheatena, bread, butter, cocoa, sugar
Lunch	Spaghetti, tomato sauce, bread, jam, milk, cookies.
Dinner	Salmon salad, mashed potatoes, rolls, butter, milk, fresh fruit, cake, bread.
Breakfast	Two boiled eggs, bread, butter, cocoa, sugar
Lunch	Pot cheese, sour cream, bread, jam, milk, fruit, jello
Dinner	Boiled beef, parsley potatoes, string beans, bananas, bread.

Staples, such as bread, butter, milk, fruit, etc., were supplied in abundance. This was repeatedly observed by the writers. Tomato juice was served every day, as well as vitamin D in some form.

Such a diet, plain but plentiful, can be seen to be adequate in vitamin and mineral content. It provides a minimum of from 2,400 to 2,800 calories. When calculated in terms of the individual foods, it is found that approximately 50 per cent of the total calories is supplied by carbohydrate, and 15 to 20 per cent by protein. The diet also provides between three to four grams of protein per kilogram of body weight. Such a diet is more than sufficient to induce normal growth and gain in weight.

The boys were carefully weighed at least once a week by each of us as a check, and their heights taken. Note was made of any subjective or objective symptoms, and of any changes in well-being, appetite, etc. After cessation of insulin administration the weighings were still continued weekly.

SECOND SERIES

Profiting by some of our observations in the preceding series, a second series of injections was undertaken in a new group of six boys. These were similar in type to the boys in the other group. One of the boys was withdrawn after one week of insulin because his mother, a nurse, objected to the injections. The other five boys were given five units of insulin twice a day, one hour before meals. Within one week the dose was rapidly increased to fifteen units twice a day. This dose, given one hour before meals was continued until the end of the experiment which lasted one month. As in the preceding experiment, the subjects were weighed naked once a week and always at the same time of day. Their heights were also recorded, here also all symptoms were carefully watched for.

At this time, eight other boys were chosen as controls. Their weights had been found to fall just within the accepted normals for age and height. On the strength of their previous records, it was reasonable to expect that they would not make unusual gains. They were subjected to the same routine as the other boys, but were given no insulin and no candy. Their diet coincided with that given the insulin subjects. They were also weighed at intervals, the last weighing being made about two months after the first.

RESULTS

The boys in the first group made no significant gain on doses under ten units twice a day. At that dose, one had gained one and one-half pounds in a week. He had complained, more than the others, of dizziness after the injections. On fifteen units twice a day the greatest gain occurred, the maximum being one and one-fourth to one and one-half pounds during any week. Yet while receiving this dose two of the subjects in the first series lost one-fourth and one-half

pound respectively. The average gain per boy in this series for the entire seven weeks of insulin administration was two pounds. This figure indicates a somewhat higher gain than that which actually occurred, because one boy who was underweight for his height only because he was growing rapidly gained four pounds, thus raising the average gain from one and one half to two pounds. Every boy weighed more at the end of the period of observation than at its beginning. The smallest gain was one pound.

Although the boys in the second group had received larger doses of insulin, the average gain during the month of observation was one fourth pound. This figure is a bit low because two of the subjects had failed to gain. In fact, they had actually lost one half and one pound respectively by the end of the experiment. The greatest gain made in this series was only one and one fourth pounds after four weeks of insulin and this in only one boy.

As has already been intimated, the gains were not progressive. Sometimes they followed a previous loss in weight, or the entire gain might be wiped out by an equal or even greater loss the following week. Some subjects lost weight at times even on the larger doses of fifteen units twice a day. It should be said, however, that the losses were never consecutive, but were usually made up for by an equal gain. The rate of gain did not differ whether the injections were given one-fourth hour or one hour before meals. The largest gain per week in either series was one and one half pounds but it is obvious that such a gain was never repeated. There was an absence in our subjects of any noticeable changes in appetite, well being or mental attitude. Increased consumption of food was not apparent. It is interesting to note that hypoglycemic reactions often caused enough dizziness to produce actual anorexia. These reactions took the form of dizziness, pallor, perspiration, faintness, hunger, and anorexia in that order of frequency of occurrence. However, these symptoms were not severe, and did not interfere very much with the boys' normal activities.

The gains made, meager as they were, began to disappear almost as soon as the injections were stopped. Within one month after cessation of insulin all the boys but one were back to their previous weights. The latter lost one and one-fourth pounds after insulin was stopped and then began to gain spontaneously. Many of the weights even went below their starting levels. Changes in height were not apparent, except in the one boy of the first series who had gained four pounds in weight. The latter grew one inch in seven weeks.

The eight control subjects made an average gain of one and one eighth pounds during the time this experiment was being conducted. Three of the boys lost from one fourth to one half pound during this

time, while the other five gained from one-half to three and three fourth pounds. This result, without insulin, coincides fairly well with the results in the insulin-treated group.

These findings have been summarized in Table I.

TABLE I
WEEKLY CHANGES IN WEIGHT

FIRST SERIES														
SUBJECT	AVER. WT.	INSULIN							NET CHANGE	AFTER INSULIN				
		1ST WK.	2ND WK.	3RD WK.	4TH WK.	5TH WK.	6TH WK.	7TH WK.		1ST WK.	2ND WK.	3RD WK.	4TH WK.	5TH WK.
L. B.	55½	55½	56	55½	56½	56½	58	57½	2	56½	56	56½	56	55½
I. F.	64½	64½	64½	64	64½	65½	65	65	½	64½	64½	63½	63½	63½
N. F.	65½	66½	66	66½	66½	68½	68½	67½	1½	67½	66½	67½	67	67½
O. K.	67½	67½	66	67½	68½	67½	68½	69½	1½	68½	67	67½	67½	66½
W. S.	79½	81½	80½	82½	83½	84½	84½	83½	4	83½	83½	84½	84½	80½

SECOND SERIES										
SUBJECT	AVERAGE WEIGHT	INSULIN				NET CHANGE	AFTER INSULIN			
		1ST WEEK	2ND WEEK	3RD WEEK	4TH WEEK		1ST WEEK	2ND WEEK	3RD WEEK	
S. N.	70½	71½	73½	72	72	1½	72½	71½	70½	
M. P.	71	71½		71½	70	-1	69	71½	71	
S. F.	100½	101	101½	102	100½	-½	101½	102	102	
J. B.	71½	72½	73½	73	72½	1	71½	72½	72½	
L. A.	69½	69½	68½	70	70½	½	68½	68½	69½	

CONCLUSIONS

1 Insulin given to nondiabetic children in doses under ten units twice a day causes no acceleration of the rate of gain in weight. No subjective or grossly objective effects are produced.

2 Doses of ten units twice a day have but a slight accelerating effect, and doses of fifteen units twice a day have a somewhat more marked accelerating effect upon the rate of gain in weight. The total gains are small.

3 The gains in weight which are induced by these doses disappear within one month after cessation of insulin.

4 The results do not warrant the injection of large amounts of insulin to nondiabetic children with the dangers incident to this procedure, for the purpose of inducing gain in weight.

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FATIGUE IN SCHOOL CHILDREN

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THIS study covers thirty-two school children ranging in age from seven to fifteen years who came to us with the outstanding complaint of persistent fatigue. Associated symptoms were an inability to carry on the usual school duties and a lack of interest in the customary activities in play and amusement. In each child the symptoms were sufficiently pronounced to cause anxiety and consultation with the pediatrician.

All were given a complete physical examination, which included blood chemistry and basal metabolism tests when such studies seemed indicated. The patients fall into two groups.

In Group I, twenty-two in number, there was a favorable response to adequate rest habits, the correction of small gastrointestinal disorders and other minor ailments. An important feature in a considerable number was the presence of a mental depression reflecting, perhaps, the home atmosphere, due to business troubles, which few of the heads of families have escaped during the past few years. Suggestions to the parents that business troubles be omitted in discussions before the patient and an assurance to the child that he was just as strong and well as other boys and girls aided in securing a satisfactory adjustment.

In Group II, ten in number, the story was quite different. The object of this article is to call attention to this group, emphasizing a factor in child life that would seem not fully appreciated. Among these there were seven boys and three girls. One boy was eight and one-half years old, the remaining nine ranged from twelve to fifteen years of age. An outstanding symptom was the inability to carry on the school activity. In three the changed reaction of the patient to this environment in the school and in the home were so pronounced that they represented behavior problems. Means of management that were successfully employed in Group I failed to make an impression.

Repeated basal metabolism tests demonstrated that these children in contrast to Group I were persistently minus. In all, the height-weight ratio was within the normal. In the girls, aged thirteen, fourteen, and fifteen years, menstruation had been established and was normal. In the boys there was no evidence of delayed sex characteristics. In four cases normality was established under thyroid gland administration as follows: one in two months, one in six months, one in eight months, and one in eighteen months.

In these the dysfunction was temporary. In two cases unusually rapid growth may have been a factor. Each patient was rendered able to carry on his usual activities for a given time through the use of small doses of desiccated thyroid gland. Evidently there was a temporary dysfunction or an excessive call upon the thyroid gland due to rapid growth or special effort demanded at school or in the home. In five cases we have been unable to discontinue the gland therapy, attempts have been followed by a cessation of activities, disturbed mental reactions and poor school work. In one case (Fig 3) the desiccated thyroid has recently been discontinued. Figs 1, 2 and 3 demonstrate the basal metabolism charts of three patients in this group.

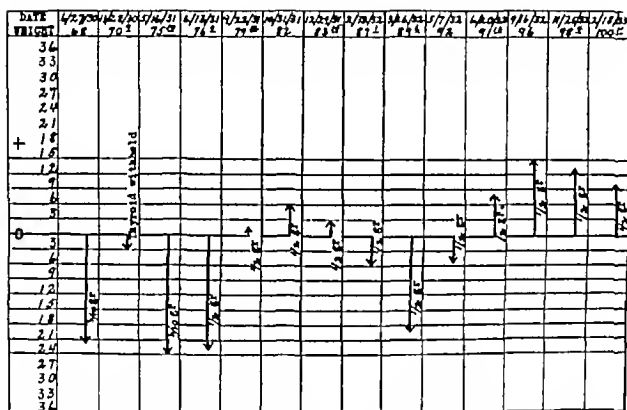


Fig 1—R. B. male aged twelve years and one month. The chart demonstrates basal metabolic rate and amount of desiccated thyroid administered daily.

SEX	AGE AT ONSET OF TREATMENT	GRAINS OF DESICCATED THYROID DAILY		DURATION OF TREATMENT
Male	13 yr	$\frac{3}{16}$ to $\frac{1}{2}$		3 yr
Male	12 yr	$\frac{7}{10}$ to $\frac{3}{4}$		2 yr 3 mo
Male	10½ yr	$\frac{1}{16}$ to $\frac{1}{4}$		3 yr 4 mo.
Male	13½ yr	14		18 mo
Female	13 yr	$\frac{3}{16}$ to $\frac{1}{4}$		1 yr
Female	13½ yr	14 to 1		2 yr 9 mo.

It will be observed in Fig 1 that the twelve year-old boy gained 28 pounds in weight and $8\frac{1}{4}$ inches in height during the two years and eight months he was under observation.

Fig 2 is a chart of a girl fourteen years old, who was physically normal, but failed signally in her school work, and was quite unable

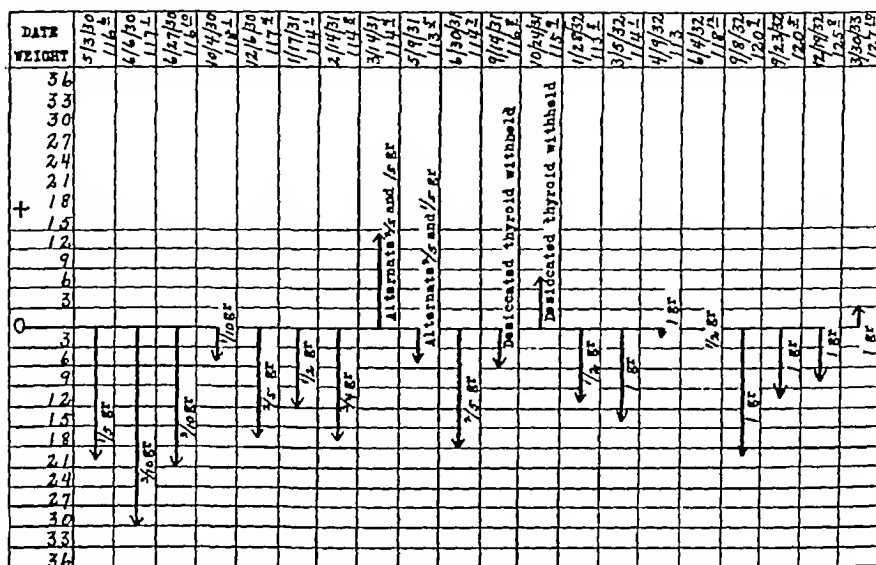


Fig 2—V D female aged thirteen years and six months, the chart demonstrates basal metabolic rate and the amount of desiccated thyroid administered daily

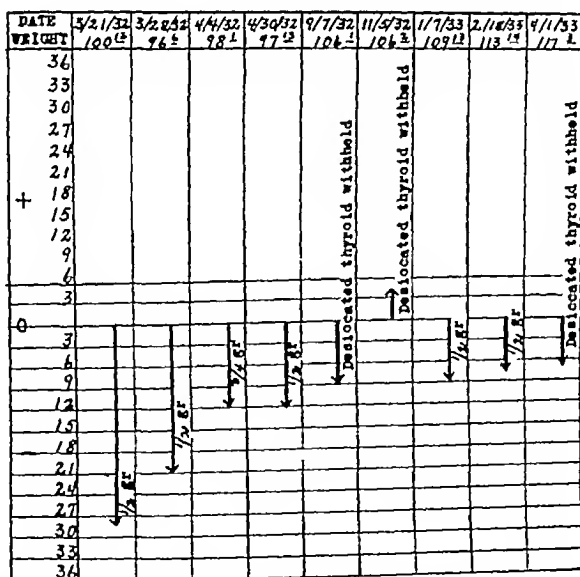


Fig 3—S S male aged thirteen years and one month, the chart demonstrates basal metabolic rate and amount of desiccated thyroid administered daily

to carry on effort in any direction. She was a source of no little anxiety to her teachers and immediate family. As a result of desic-

cated thyroid administration, she took her place in the class and, for efficiency in her studies won a scholarship to a private school for girls.

In Fig 3 is shown the chart of a thirteen year-old boy in whom we have recently discontinued the use of desiccated thyroid medication. It will be observed he has gained $18\frac{1}{2}$ pounds in weight and $3\frac{1}{8}$ inches in height in thirteen months. We feel the discontinuance of the thyroid for this boy was warranted on account of the complaint of dizziness and headaches, and an apparent return to normality in his school and family reactions. There had been a complaint of a similar nature four months prior to this when the thyroid medication was discontinued. However, the resumption of its use was required on account of a return of the mental disability.

COMMENT

Our study covers thirty two children in whom disease of any nature was proved absent. They came to us from different sections of the country and for one reason only, that of fatigue—an absence of initiative and capacity for effort. Twenty two were permanently relieved through an adjustment of living conditions in the home and through the correction of small physical ailments which related particularly to activities, sleep, diet, and bowel function.

Unfavorable domestic environment was of etiologic significance in a few of the children. In ten cases repeated basal metabolism observations showed an endocrine dysfunction as a causative agent.

Particularly of interest in this group was the demonstration both clinically and by repeated metabolic observation of the potency of small thyroid dosage. This observation suggests the thought that small amounts of animal thyroid might act as an excitator of a familial tendency to thyroid dysfunction to normal efficiency.

It is to be understood in these children there was no suggestion of myxedema, no obesity, and no delay in sex characteristics. We feel that the administration of the desiccated thyroid will have to be maintained until adolescence is passed and the competitive stressful school existence has been concluded. We are also confident that if these children had not had the value of thyroid gland therapy, they would not have been able to carry on their usual school activities.

THE USE OF OXYGEN IN THE CARE OF FEEBLE PREMATURE BABIES

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AT THE suggestion of Dr. H. E. Utter, an oxygen box as described by Burgess¹ was introduced into the nursery of the Providence Lying-In Hospital. This apparatus consists, in principle, of a box open at the top. The oxygen is admitted through tubes at the sides. Being heavier than air, it increases the oxygen content in the box. One side of the box is replaced by a rubber sheet with a hole in it, the edges of which fit tightly around the baby's abdomen, leaving his hands and shoulders inside and his lower trunk and legs outside.² This is described and illustrated in the original article by Burgess. We found that when oxygen was run in at the rate of one liter per minute, the percentage of oxygen in the air at the bridge of the baby's nose was about 30. This percentage was determined by the Yandell-Henderson Syringe method. At first we used the box for several hours at a time on sick, newborn babies. Later a very feeble premature baby did so well in the box that she was left in for nine days. Two others received this treatment for fourteen and three days, respectively, apparently with great benefit. These three cases furnish the material for this communication.

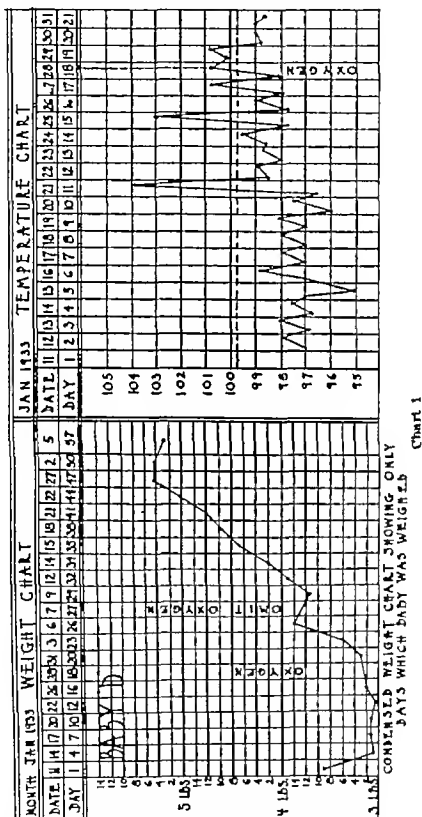
Baby D was born January 1, 1933, nine weeks before the estimated date, weighing three and one half pounds. There were no important abnormalities of prenatal period or labor. Since her condition was poor with some cyanosis, a mixture of oxygen and carbon dioxide was given. (Chart 1.) A little breast milk was given with an evaporated milk formula for the first week, and, after that, evaporated milk, Karo and water until the baby left the hospital.

On the eighteenth day of life the baby's condition became very poor, she could not retain food, and her color was poor. At this time she was put in the oxygen box and left there for nine days, except for intervals of a few minutes. Within twenty-four hours, her appearance had become good, and in the nine days following, she gained twelve ounces. Immediately after beginning the administration of oxygen, her temperature, which had been difficult to control, kept within satisfactory limits. Her chart tells the story clearly. She left the hospital in eight weeks, weighing five pounds. The family then left town, and we have been unable to follow the case.

Baby J was born February 12, 1933, weighing three pounds and six ounces. There were no important abnormalities of the prenatal period or labor. The baby was estimated nine weeks premature. Because her condition and color were only fair, she was put in the oxygen box immediately. She was kept in for twenty

two of her first thirty-two days and was fed entirely on evaporated milk formula by gavage. At fifteen weeks she weighed six and one-half pounds and was in good condition. (Chart 2.)

Baby C, born March 23 1933 weighing three pounds and fourteen ounces, was estimated to be six weeks premature. There were no important abnormalities of the



prenatal period or labor. An oxygen and carbon dioxide mixture, together with artificial respiration, was necessary to start her breathing. She was sent to the premature nursery in poor condition. For the first two days her temperature was always under 94° F. She was fed on an evaporated milk formula by gavage. From

the first day she was kept in the oxygen box. Her color was improved when the rate of oxygen flow was increased to $2\frac{1}{2}$ liters per minute, or 45 per cent. Beginning on the fourth day of life, her temperature stayed almost steadily above 98° F. Oxygen was discontinued at this time because the box was needed for a sick baby

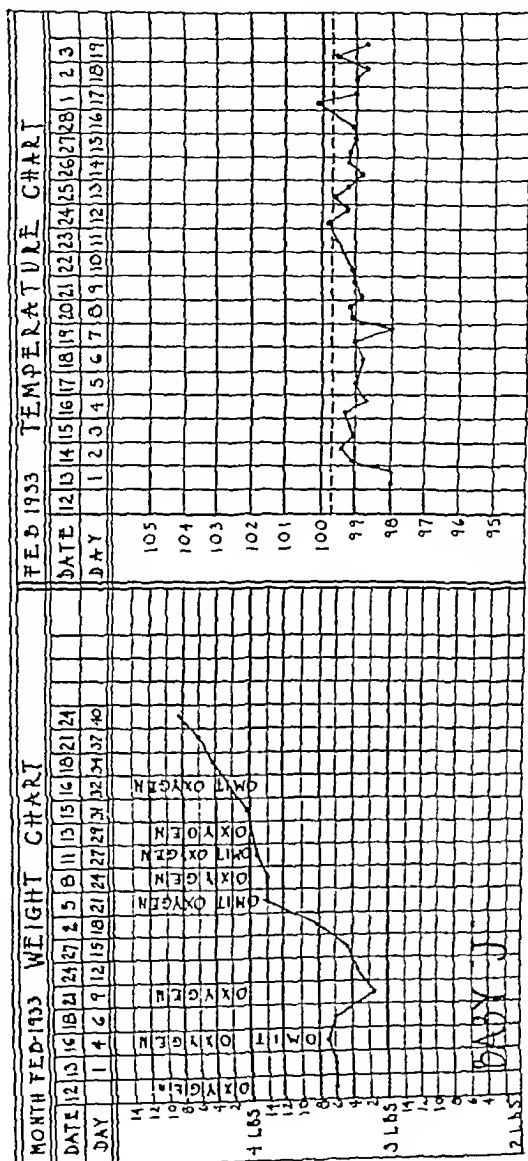


Chart 2

Although she did not gain at first, her condition was not bad. Since then she has done well. At ten weeks she weighed five pounds ten ounces.

Charts 1, 2, and 3 show the weight and temperature charts of the three babies. The weight charts have been condensed so that they show only the days on which babies were weighed and those on which

the oxygen was given or omitted The temperature charts show the first twenty one days of life

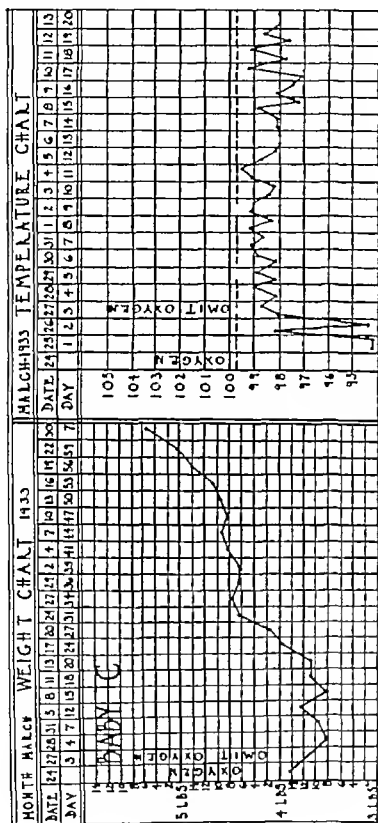


Chart 3

SUMMARY

Three babies were kept in an oxygen box where they breathed an air with added oxygen The improvement in their appearance and general condition was striking They have all done well since, although before oxygen was administered the prognosis seemed poor

CONCLUSION

A continuous supply of oxygen seems to be of advantage in treating feeble, premature babies

NOTE Since the above cases have been treated, we have been using a larger box in which the entire baby can be placed

REFERENCE

- 1 Burgess, A M, and Burgess, A M, Jr New England J Med 207 1078, 1932

122 WATERMAN STREET AND PROVIDENCE LYING IN HOSPITAL

THE SERUM TREATMENT OF PNEUMONIA IN CHILDREN

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NEW YORK N Y

THIS study was carried out for two successive years up to July, 1933, in the pediatric service of Fifth Avenue Hospital. Our purpose was first to find out which types of pneumococcus are most frequently found in lobar and bronchopneumonia among children; second to determine the mortality, length of disease and frequency of complications among the pneumonia cases; and third, to learn whether the administration of specific antipneumococcus serum decreases the mortality, shortens the course of the disease, and lessens the frequency of complications.

SELECTION OF CASES

Our procedure in finding the answer to these three questions was to type as soon as possible after admission each case which showed signs of pneumonia. The mere fact that we typed a case did not mean that it was used in the study. We included a case in our series only if by the time the type of pneumococcus was reported the patient still had pneumonia with fever above 100° and was not moribund. When the report of the pneumococcus type came back after the patient had died the cases were not included as controls because we had no choice of using them as controls or serum treated cases. This lack of choice compelled us to eliminate patients who recovered before the time the type report was obtained. Since it would have been unnecessary to give the serum to these cases at the time when the pneumococcus type was obtained, we could not in fairness use them as controls. If the pneumococcus type was one for which we had no serum, the case was placed in a separate category. If the pneumococcus type proved to be one for which serum was available, we made the case a control or serum treated case trying to have equal numbers in each group of each pneumococcus type. As far as it was possible, we also tried to match the cases according to age and severity of disease. Altogether

From the Fifth Avenue Hospital, New York City (Director of Pediatrics, Dr. Frederick Bartlett), and from the Research Laboratories, Department of Health (Director William H. Park.)

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we attempted to type 131 cases. Only seventy-six are used in our serum study. The reasons for not including the remaining fifty-five cases are given in Table I.

TABLE I
REASONS FOR EXCLUDING 55 CASES

REASON	TOTAL NO	DIED
No pneumococci found	16	2 12%
Child died before report of the type was received	3 {	3 { 14%
Child had no fever at the time type was received	18 {	- {
<i>Pneumococcus meningitis</i>	1	1 100%
<i>Pneumococcus peritonitis</i>	1	-
Pleural effusion at admission	5	-
Unresolved pneumonia	2	-
Upper respiratory infection	5	-
Pneumonia diagnosis was erroneous	4	-
TOTAL	55	6 11%

If we considered as controls the patients who lost their fever and the patients who died by the time the type report came back, the control mortality would be 14 per cent. Whereas, as shown in Table V, if we count as controls only the patients who had neither died nor lost their fever by the time the pneumococcus type was reported to us, the control mortality is only 7 per cent for those which could have been treated with serum. This method of selecting suitable cases for study might explain why our results with pneumococcus serums seem to be less favorable than those reported by some other workers.

FREQUENCY OF PNEUMOCOCCUS TYPES

Table II shows the frequency of the different pneumococcus types in all the cases where types were obtained. It is interesting to note that the dominating types among children are XIV, XIX, I and VI. Two or more types occur in about one-fourth of the cases. The age of our children varied from two months to eleven years of age, which explains why the frequency of pneumococci, falling into different types, varied from the order most commonly found in pneumonia of adults.

Two-thirds of the cases were lobar pneumonia with a mortality of 3 per cent. The remaining third were bronchopneumonia with a mortality of 20 per cent. These are total figures including both serum-treated and nonserum-treated cases. The two cases with pneumococcus meningitis died. Types XVIII and XIX seem to be especially dangerous. Empyema, as a complication, occurred in 11 per cent of the pneumonia cases. Only one of the thirteen empyema cases followed bronchopneumonia.

TABLE II
FREQUENCY OF PNEUMOCOCCUS TYPES AMONG CHILDREN

TYPE	TOTAL NUM BER	PER CENT	EMPIEMA	LOBAR PNEU MONIA	LOBAR PNEU MONIA DEATHS	BRONCHO PNEU MONIA	BRONCHO- PNEU MONIA DEATHS	PNEUMO- COCCUS MENINGITIS	PNEUMO- COCCUS MENINGITIS DEATHS	PNEUMO- COCCUS PERITONITIS	PNEUMO- COCCUS PERITONITIS DEATHS	NO PNEU MONIA	NO PNEU MONIA DEATHS
I	10	9%	2	20%	10	-	-	-	-	-	-	-	-
II	1	1%	-	-	-	1	-	-	-	-	-	-	-
III	3	3%	1	33%	3	-	-	-	-	-	-	-	-
IV	6	4%	-	-	4	-	-	-	-	-	-	-	-
V	4	3%	1	25%	3	1	-	-	-	-	-	-	-
VI	7	6%	1	14%	4	1	-	-	-	-	-	-	-
VII	3	3%	-	-	2	1	-	-	-	-	-	-	-
VIII	1	1%	-	-	1	1	-	-	-	-	-	-	-
IX	3	3%	1	33%	3	-	-	-	-	-	-	-	-
X	2	2%	-	-	1	-	-	-	-	-	-	-	-
XI	17	16%	3	18%	15	2	100%	-	-	-	-	1	-
XII	4	3%	1	7%	3	7	43%	1	100%	-	-	-	-
XIII	14	12%	-	-	2	-	-	-	-	-	-	-	-
XIV	2	2%	-	-	2	-	-	-	-	-	-	-	-
XV	3	3%	-	-	3	-	-	-	-	-	-	-	-
XVI	3	3%	-	-	3	-	-	-	-	-	-	-	-
XVII	1	1%	-	-	1	-	-	-	-	-	-	-	-
XVIII	2	2%	-	-	2	-	-	-	-	-	-	-	-
XIX	2	2%	-	-	2	-	-	-	-	-	-	-	-
XX	2	2%	-	-	2	-	-	-	-	-	-	-	-
XXI	2	2%	-	-	2	-	-	-	-	-	-	-	-
XXII	2	2%	-	-	2	-	-	-	-	-	-	-	-
XXIII	2	2%	-	-	2	-	-	-	-	-	-	-	-
XXIV	2	2%	-	-	2	-	-	-	-	-	-	-	-
XXV	2	2%	-	-	2	-	-	-	-	-	-	-	-
XXVI	2	2%	-	-	2	-	-	-	-	-	-	-	-
XXVII	2	2%	-	-	2	-	-	-	-	-	-	-	-
XXVIII	2	2%	-	-	2	-	-	-	-	-	-	-	-
XXIX	2	2%	-	-	2	-	-	-	-	-	-	-	-
Mixed types	28	24%	3	11%	17	10	10%	-	-	1	-	-	-
Totals	116		13	11%	75	30	6 20%	2	2 100%	1	-	7	-

RESULTS OF PNEUMOCOCCUS TYPING FROM DIFFERENT MATERIALS

Our routine method to obtain the type of pneumococcus was to secure a laryngeal swab*. One hundred and thirty-one cases were typed in this way, 87 per cent giving positive pneumococcus findings. The time required for the laboratory to make the type report on the throat swab was from six hours to two days. Since the type of pneumococci which are present in the throat are not necessarily the ones which cause the lung pathology, we decided to make both lung suction and throat-swab examinations on a limited number of cases.

The lung suction consisted of making a puncture into the portion of the lung showing the most definite pathologic signs on physical or roentgen examination. For this purpose a 10 c c syringe was used, with a 6-inch, 20-gauge needle. Four to 5 c c of plasma broth were drawn into the syringe and all air expelled. The media was then forced through the needle until it was quite certain that the entire length of the needle was filled by the broth. The needle was then inserted into the chest wall in the manner of an ordinary thoracocentesis. The proper limit of insertion was ascertained by the sense of resistance to the needle when it entered the lung parenchyma and the needle was forced into the lung tissue. The piston of the syringe was then pulled out partially and the media drawn into the barrel. The needle was then withdrawn and the media expelled into the culture tube. The needle was rinsed by repeated suction and expulsion of broth into the culture tube. Novocaine anesthesia was used on older children.

Throat swabs and material from lung suction were obtained in twenty-eight cases. Only 17 per cent positive results were obtained by one lung suction, in contrast to 60 per cent of the cases giving positive results by the first throat swab. A second throat swab examination brought the percentage of positive findings up to 96 per cent. We did not find the lung suction a quicker method because the average time needed for the laboratory to report on a lung suction was 17 days while only 14 days were required for the reporting of a throat swab. Twenty-four of the twenty-eight patients used for lung suction had lobar pneumonia in which the place of pathology could be fairly easily determined. We had no complications such as pneumothorax or atelectasis from lung suction. Empyema, as a complication, occurred in 10 per cent of the cases which had lung puncture. As the frequency of empyema in our total group was 11 per cent we do not think that lung suction increased the frequency of empyema among our cases. Of the five cases with positive results for pneumococci, four showed the same one or two types as were found by the

*The swab was obtained with an ordinary applicator by attempting to reach the larynx and getting the child to cough up some of the sputum on the applicator. The swab was then placed in a culture tube of broth.

throat swab One case showed Type III by swab and Type I by lung suction As a whole we do not see a sufficient advantage in using lung suction routinely instead of the throat swab for the determination of the pneumococcus type

From sixty five cases one or more blood cultures were taken Only four (6 per cent) showed positive results In two of the four cases the type in the blood corresponded with the type in the throat In one of the cases no throat swab was obtained, and in the fourth case the throat swab showed Type XIX and the blood culture Type I pneumococci One case had confluent bronchopneumonia, the other pneumococcus meningitis Both were fatal The third patient with lobar pneumonia and the fourth with pneumococcus peritonitis recovered

We had the opportunity to type the pus of ten cases of empyema Six were positive and of these five corresponded with the type of pneumococci obtained by throat swabs while the sixth did not

We studied the urine of five cases for precipitins All five corresponded in type with the pneumococcus occurring in the throat However, other types were also precipitated which confused the results

Table III gives the summary of the above described typings of different materials We must remember in making comparisons that only one examination per case was done in almost every instance except in case of throat swab examinations where swab taking was repeated several times until the type could be ascertained However 75 per cent of the cases were typed from the first throat specimen

TABLE III
PNEUMOCOCCUS TYPING FROM DIFFERENT MATERIALS

MATERIAL USED FOR TYPING	TOTAL NUMBER	TYPE OBTAINED	CORRESPONDENCE WITH THROAT SWAB	REMARKS
Throat swab material	191	117 87%		For one case no throat swab was obtained
Lung suction material	28	17%	4 80%	
Blood	0	4 6%	1 67%	
Pus from empyema	10	0 60%	5 83%	
Urine	5	5 100%	5 100%	

PNEUMOCOCCUS SERUM TREATMENT OF PNEUMONIA IN CHILDREN

Serum was given intramuscularly or intravenously after skin and conjunctival tests for sensitivity were done Where the sensitivity tests were found to be positive the patients were first given small doses of serum in an attempt to desensitize The dosage was increased as the sensitivity was overcome

It was our intention to give approximately 1,000 units per pound of body weight per day to children over the age of two years, and about 2,000 units per pound per day to children under this age. This purpose could not always be adhered to as the titer of our serum varied—and with serum of low titer the dose of serum required became an impracticably large volume. In other cases the dose had to be diminished because of sensitivity.

The total dose for the twenty-four hours was divided into from three to four parts and given at intervals of from six to eight hours. The gluteal muscles were the area of choice for intramuscular injection, and the cubital or jugular veins or the longitudinal cerebral sinus for intravenous injections.

In order to compare the results in the serum-treated and control cases, we devised a scoring system for evaluating the severity of the cases before serum treatment was started, or before the case was put into the control groups. In this way, cases of similar age, color, bacteriological type, nutrition and complicating factors could be compared by score. The system is shown with the ratings given to the various findings in Table IV.

TABLE IV
RATINGS FOR PNEUMONIA STUDY

MAXIMUM SCORE 100, REPRESENTING THE WELL CHILD

1	Cardiorespiratory System	-----	25	
		Deduct		Remarks
	Cyanosis	5 - 10		(Respirations 10-20 over normal 5)
	Dyspnea	5 - 10		(Respirations more than 20 normal 10)
	Pulse rate	5 - 10		(Pulse rate 20-40 over normal for age 5)
	Pleurisy	5		(Pulse rate more than 40 over normal 10)
2	Gastrointestinal System	-----	25	
	Diarrhea	5 - 10		
	Vomiting	5 - 10		
	Distention	5 - 10		
3	Evidences of Toxicity	-----	20	
	Bacteremia	10 - 20		(Less than 5 colonies 10) (Over 5 colonies 20)
	WCB	5		(WBC below 10,000 or above 35,000 5)
	Marked enlargement of liver	5		
	Temperature	5 - 10		(Temperature above 105° or below 98°)
4	Nervous System	-----	15	
	Irritability, sleeplessness or delirium	5		
	Meningismus	5		
	Convulsions	5 - 10		
	Apathy	5		
	Coma	10		
5	Constitutional Factors	-----	15	
	Organic heart lesions	5 - 10		
	Severe malnutrition	5 - 10		
	Active severe rickets	10 - 15		
	RBC	5		(Red blood cells below 4,000,000 or Hgb below 60%—5)

TABLE V
SUMMARY OF PNEUMONIA SERUM TREATMENT STUDY

	TOTAL NUMBER	NUMBER OF DEATHS	AVERAGE DURATION AGE	AVER AGE	COMPLICATIONS	LOBAR PNEU MONIA	AVER AGE SCORE	COMPLI CATIONS	MIXED TYPES
Controls with types to which no serum is available	16	6%	9 days	1.9 yr	4 otitis med.	75%	80	25%	18%
Controls with types to which serum is available	98	7%	10 days	2.8 yr	5 otitis med. 1 pleurisy 1 empyema 1 alim. intox.	64%	78	28%	32%
Intramuscularly serum treated cases.	17	6%	9 days	3.0 yr	3 otitis med. 2 empyema	79%	70	20%	20%
Intravenously serum treated cases.	15	13%	8 days	3.1 yr	1 otitis med. 3 empyema	86%	75	26%	13%
All serum treated cases.	32	9%	8½ days	3.3 yr	4 otitis med. 3 empyema	81%	70	23%	22%
Total number of treated and nontreated cases.	66	9%	9 days	2.8 yr	13 otitis med. 1 pleurisy 6 empyema 1 alim. intox.	76%	77	24%	25%

Remarks. At present antipneumococcus serums are available to the following types I, II, III, IV, V, VI, VII, VIII, IX, XII, XV, XVIII, XIX, XXII

TABLE VI
PNEUMONIA SERUM TREATMENT STUDY

TYPE	CONTROLS				INTRAMUSCULARLY TREATED CASES				INTRAVENOUSLY TREATED CASES			
	TOTALS	DIED	DURAT	COMP	TOTALS	DIED	DURAT	COMP	TOTALS	DIED	DURAT	COMP
I	1-0	0	10	0	3-0	0	9	1 empyema	4-0	0	7	1 empyema
II	1-0	0		1 otitis					1-0	0		1 empyema
III	2-0	0	7	0					1-0	0	11	0
IV	1-0	0	5	0	1-1	0	10	1 otitis empyema	1-0	0	7	0
V												
VI	1-1	0	9	0	2-1	0	9	0	2-0		9	1 empyema
VII												
VIII					0-1	0		0				
IX												
XIV	4-2	0	10	1 pleurisy 1 otitis media 1 parulenta 1 alum intox	2-0		10	0	3-0	1 lobar pneumonia	8	1 otitis
XV												
XVIII	1-0	0	8	0	1-0	0		1 otitis	0-1	1 broncho pneumonia		0
XIX	2-3	2 broncho pneumonia	10	3 otitis								
XXII												
Mixed types	5-1	0	11	1 alum intox 1 empyema	4-1	1 lobar pneumonia	9	1 empyema 1 otitis	1-1	0	7	0
No serum	12-4	1 broncho pneumonia	9	4 otitis					-			
Totals	40-14	3 broncho pneumonia			13-4	1 lobar pneumonia			13-2	1 lobar pneumonia 1 broncho pneumonia		

Remarks—First figure in totals: lobar pneumonia
Last figure in totals: bronchopneumonia

During the first year of our study we administered the antipneumococcus serum intramuscularly. As our results were not encouraging, during the second year we chose the intravenous method. As shown in Table V the results with the intravenous injections were as decisive as with the intramuscular method. The mortality rate was not lower in the serum treated group than in the controls. There was a slightly shorter duration in the serum treated group—a nine day average in the intramuscularly and an eight-day average in the intravenously treated group against a ten-day average among the controls. The frequency of complications was alike in practically all groups. In order to find if any special reason existed why the serum treated cases did not do better they were studied from different points of view and compared with the controls of similar pneumococcus types. We know that the mortality rate of bronchopneumonia is greater than the death rate of lobar pneumonia and that younger children have a greater mortality rate than older ones. Also, if more than one pneumococcus type is found in a case the serum treatment is more difficult since we do not know which type caused the disease, and serum may not be available for more than one type. Finally, the prognosis is worse if the child is more sick and toxic clinically. One can see from Table V that the serum treated cases had no apparent handicap from any of these factors. Lobar pneumonia was more frequent among these patients; they were on the average older; they had somewhat less frequently mixed types of pneumococci; and as judged by our scoring system they were not more sick when selected for treatment than were the controls. Therefore the apparent failure of serum treatment might be due to the small number of cases upon which it was tried.

In Table VI the seventy-six cases are arranged according to types. The mortality for bronchopneumonia is considerably higher than the death rate for lobar pneumonia. Type XIX seems to be particularly dangerous.

Table VII also shows the deaths among the seventy-six cases tabulated above according to age and type of pneumonia.

Table VIII shows the details of serum treatment. We note that the interval between injections was nine and one half hours in the intramuscularly and eight and one half hours in the intravenously treated cases. In both groups treatment was started on the average, between the fifth and sixth day of the disease. Thirty three per cent of the intravenously treated cases showed mild signs of serum shock, one of them died. As death occurred one hour after the administration of serum it is not certain whether it was a serum death. Intramuscularly treated cases had no signs of shock. A thermal reaction was noted in 17 per cent of the intramuscular and 26 per cent of the intravenous

TABLE VII
LOBAR AND BRONCHOPNEUMONIA CASES TABULATED BY AGE

	ALL CASES ALL AGES		LOBAR PNEUMONIAS LESS THAN TWO YEARS OF AGE		LOBAR PNEUMONIAS MORE THAN TWO YEARS OF AGE		BRONCHO PNEUMONIAS LESS THAN TWO YEARS OF AGE		BRONCHO PNEUMONIAS MORE THAN TWO YEARS OF AGE		ALL PNEUMONIAS LESS THAN TWO YEARS OF AGE		ALL PNEUMONIAS MORE THAN TWO YEARS OF AGE	
	TOTAL	DEATHS	TOTAL	DEATHS	TOTAL	DEATHS	TOTAL	DEATHS	TOTAL	DEATHS	TOTAL	DEATHS	TOTAL	DEATHS
Controls with types for which no serum is available	10	1 6%	5	-	4	-	3	-	2	1	10	-	6	1
Controls with types for which serum is available	38	2 7%	8	-	1	-	9	2	2	-	17	2	11	-
Intramuscularly serum treated cases	17	1 6%	5	-	7	1	4	-	1	-	9	-	4	1
Intravenously serum treated cases	15	2 13%	5	1	9	-	1	1	-	-	6	2	9	-
All serum treated cases	32	3 9%	10	1	16	1	5	1	1	-	15	2	17	1
All pneumonia cases	76	6 8%	23	1 4%	29	1 3%	19	3 15%	3	1 20%	42	4 9%	31	2 6%

TABLE VIII
SERUM TREATED CASES

SERUM TREATED CASES																
TYPE OF CASE	TOTAL NO OF CASES	AVERAGE TOTAL NO OF UNITS	AVERAGE INTERVAL IN HOURS BETWEEN INJECTIONS	AVERAGE NO OF INJECTIONS	AVERAGE AMT OF SERUM GIVEN		AVERAGE AMT OF SECOND DAY IN UNITS	AVERAGE UNITS PER POUND PER 24 HOURS	AVERAGE DAY OF ILLNESS WHEN FIRST TREATED	SHOCK	THERMAL RE ACTION	CHILLS				
					FIRST DAY IN UNITS	13 cases										
Intramuscularly treated cases	17	95,666	9½	7	42,204	32,907	1,518	57	0	33%	1 death	58%				
Intravenously treated cases	15	37,133	8½	4*	21,815	14,666	947	58				40.0%				

*Four cases received only one injection

* Four cases received only one injection

group. Chills were observed in 58 per cent of the intramuscularly and in 40 per cent of the intravenously treated cases. As a whole the intravenous serum administration seemed to be a more severe and less comfortable method of treatment than the intramuscular route.

We treated seven Type I pneumococcus pneumonia cases, all of which recovered in a shorter average time than did the one untreated case which was kept as a control.

CONCLUSIONS

1. The most frequent pneumococcus types among children were XIV, XIX, I and VI. Types XIV and I were likely to cause lobar pneumonia whereas type XIX is most commonly found in bronchopneumonia.

2. The mortality from lobar pneumonia was 38 per cent, the death rate of bronchopneumonia 16.6 per cent in the series studied.

3. The average duration of pneumonia without serum treatment was ten days. If serum was given intramuscularly the time was decreased to nine days and when the serum was given intravenously the length of disease was eight days.

4. Statistically there is no evidence that the serum treatment decreased the death rate. The number of our cases in the different types was too small to permit us to expect such evidence and furthermore, the cases were obtained in late stages of the disease. Many more cases must be treated before we can be ready for a final decision in regard to the value of serum treatment. Analyzing the value of serum treatment on the different pneumococcus types we find that Type I pneumonia seems to respond best to the specific treatment. As the serum has proved its value in lobar pneumonia in adults it is somewhat significant that all seven cases of this type recovered in our series.

5. The multiplicity of pneumococcus types, the difficulty in identifying the type, the difficulty in obtaining potent serums for a variety of types, the necessity of the administration of serum at an early stage of the pneumonia and finally the careful attempt to avoid serum sickness and serum shock makes this research a difficult and time-consuming piece of work. It is evident that potent serum for at least the dominant types must be provided and that many more cases must be treated before a final conclusion can be reached as to the practical value of the serums in the pneumonias due to the different types of pneumococci. To obtain this knowledge it will be necessary to utilize the children's services in a number of hospitals and the help of sufficient bacteriologists.

CALCINOSIS UNIVERSALIS AND DERMATOMYOSITIS

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ABERRANT deposition of calcium in the various tissues and organs has been noted for many years and described by a large number of authors. There are apparently three main divisions under which this type of disturbance is seen.

Progressive Myositis Ossificans—Munchmeyer¹ reported one case of his own and twelve from the literature in 1869. Helferich² in 1879 called attention to the prevalence of microdactyly and absence of a phalanx of the great toe in 75 per cent of his cases, which were similar to those of Munchmeyer. This type is apparently a distinct entity from the other two, inasmuch as the presence of congenital defects in such a large percentage of his cases would tend to prove an inherent deviation of calcium metabolism irrespective of other causative factors.

Metastatic Calcinosis—This type is peculiar in that calcium deposits are found in the heart, lungs, kidneys and other organs while the muscles, fasciae and subcutaneous tissues are usually unaffected. With this condition there is usually a hypercalcemia and for that reason it is thought to be endocrine in origin and associated with some dysfunction of the parathyroids.

Calcinosis Universalis—This third type, the one with which we are concerned in this paper, is characterized by calcium deposits in the tendons, fasciae and subcutaneous tissues without history of trauma, congenital defects, or hypercalcemia.

The first authentic case of this group was described in 1878 by Weber,³ who considered it a form of gout. Since then, the condition has been the subject of a great deal of discussion as to etiology, pathology and therapy.

Durham⁴ in a very excellent publication has reported a case associated with scleroderma and has reviewed the literature up to 1928. Since then, a number of cases have been reported.

Barr⁵ describes calcinosis as a condition found with scleroderma and considers that it might possibly be due to deposition of calcium in dead or dying tissue and states the belief that most cases of abnormal calcification depend upon diminished blood supply and that they are preceded by changes resembling hyalinization.

Langmead⁶ believes that scleroderma, dermatomyositis, calcinosis and myositis fibrosa are all related, that scleroderma and dermatomyositis are

almost inseparable and that universal calcinosis is probably a subsequent development.

Aisenberg⁷ reports a case following soon after a malarial attack and believed it due to changes in calcium metabolism following injury to the parathyroids by the malaria.

Weil and Weissmann Netter⁸ believe that the gouty diathesis is in part responsible for the development of the condition.

Moggi⁹ considered his case to be due to excessive cholesterolemia due to prolonged exposure to the sun, the subject being inherently hypercholesteremic. He warns that this etiology cannot be ascribed to all cases.

Weissenbach, Basch and Basch¹⁰ believe that endocrine dysfunction may play a part but that tissue injury is the important factor. They observed circulatory injury with capillary disorder in all cases leading to degeneration of connective tissue with secondary sclerosis.

Scholz¹¹ showed that the calcium deposits are not limited to areas under sclerosed skin but may be under apparently normal skin. He believes it dyatrophic and metastatic.

Weissenbach, Francon and Robert¹² presented a case of subcutaneous calcification in which there was a family history of a marked tendency to calcium deposition and believes there is an endocrine background with local irritation in his case.

Von Bernuth¹³ reported no calcium metabolic disturbance. He believes it is dependent on primary disease of the connective tissue which may be congenital or endocrine in origin.

Bauer, Marble and Bennett¹⁴ conducted extensive metabolic studies on the case of Wilens and Derby¹⁵ and came to the conclusion that the condition was the result of a disturbed calcium metabolism.

The case herewith reported is presented in detail to show the development of the condition from the time of its inception to the development of calcification some two years later. It is fortunate that in the early stages the patient was confined in Harper Hospital, Detroit and the University Hospital, Ann Arbor, where his case was carefully studied, the staffs of which we are indebted to for the use of their histories of the patient's stay in each institution.

CASE REPORT

The patient, a nine-year old boy was seen on June 1 1932 complaining of stiffness of the joints with subcutaneous nodules scattered over the body.

Past History.—He had chickenpox in his third year and was circumcized in his fourth year. Pertussis in 1928 pneumonia in 1928 tonsillectomy and adenoidectomy in 1928 measles in May 1929.

Birth History.—Full term normal noninstrumental delivery. Birth weight 9 pounds 8 ounces.

Family History.—Father and mother are living and well. No history of any condition simulating that of the patient.

History of present illness—The mother states that in March, 1928, while in Florida he contracted pertussis, which lasted through April, May, and June. In June he was suddenly taken acutely ill with high fever and severe pains, which were apparently muscular. These pains were at first confined to the arms and legs, but gradually spread to all parts of the body although the arms and legs continued to be most affected, possibly because of the more frequent attempt to use them. There was at no time any swelling of the joints. Several days after the onset of the attack it was noticed that opening the mouth was painful and restricted and that there was some swelling of the face. During this acute period the pain was exquisite, the child could not be touched anywhere without screaming. This acute stage lasted for four or five days after which the temperature subsided and the tenderness decreased. However, there began a gradual progressive restriction and weakness of muscular movement. This became so severe that on December 5 he was admitted to Harper Hospital for study. In the interim between the acute attack and his admission to the hospital, the tonsils had been removed, which procedure was followed by pneumonia.

A résumé of his history at Harper Hospital is as follows:

"At first movement was not impaired. Later there was some inability to flex arms and legs. At the present time he walks on his toes and is unable to rise when he falls down, which is frequent. He cannot walk up or down stairs and must be carried most of the time. When he eats, he cannot bring his arm up to his mouth, he must move the head forward to meet the hand. He sits on the edge of the chair and is unable to sit up straight.

"Patient is well developed and well nourished. The cheeks seem somewhat puffed out and edematous, the eyelids are swollen. He does not appear acutely ill but is unable to sit up in bed. There is no muscular atrophy in the extremities. There is questionable hypotenar atrophy. The fingers are semiflexed, and he is unable to extend them normally. There is limitation of abduction in both arms. The legs are kept in semiflexed position and the Achilles tendons are contracted. Palmar flexion is present. He is unable to place foot at right angle to leg, and he is unable to flex leg on thigh or thigh on abdomen. This is bilateral. There are no sensory changes."

Laboratory Findings—Hemoglobin, 85, RBC, 4,300,000, WBC, 12,000, polymorphonuclears, 65 per cent, lymphocytes, 27 per cent, monocytes, 3 per cent, eosinophiles, 5. Urine was negative in all respects. NPN, 27.3, sugar, 0.066 mgm, Wassermann, negative, gold chloride 000,000,000, throat culture, staphylococcus.

The last progress note, January 5, 1929: "In general appearance the boy has not improved. He is docile and without spirit. His lips are a bluish color, and his skin has a pale bluish sheen. The general muscle tone is less. There is coordination in the movements of the body, but the grip and power of the upper extremities is reduced. Reflexes here are absent. There is a marked weakness in the lower extremities, almost to total paralysis with a mild contracture of the knee joint and slight toe slope. Here also reflexes are absent. Skin reflexes, subcutaneous and cremasteric are active. There is no Babinski reflex. Sense of motion and position is undisturbed. There are no sensory changes in the body."

He was discharged January 17, without diagnosis, and referred, for further study, to University Hospital, Ann Arbor, where he was admitted January 28, 1929. A résumé of the University Hospital records is as follows:

"Examination revealed generalized muscular weakness, but no paralysis was demonstrable. There were bilateral equinus deformities and bilateral flexion deformities of the hip. The only obtainable reflexes were the Achilles. The patient was given a complete electromuscular examination, and the muscles responded in the

normal way to the galvanic and faradic current. The entire dorsal and lumbar spine and pelvis were examined by the x-ray department with negative results. X-ray examination of entire lower extremities was negative, as were both elbows, wrists, and forearms. The patient ran 100 F temperature during entire stay in hospital. The Kahn test was negative and the W.B.C., 6,000 with 75 per cent hemoglobin. No smear was made. The urine was negative.

"Patient was given physiotherapy in form of ultraviolet light, bakes massage and active exercise in an attempt to correct his deformities and to increase the muscular system. On May 8, the patient was manipulated and the deformities corrected, following which physiotherapy was again started. He was discharged May 6 1929. Patient was last seen in the clinic August 20, 1930, at which time the following note was made: 'Patient returns walking without pain and with marked improvement in all joints.'

"A diagnosis of residual poliomyelitis was made but the Orthopedic Department never felt this was the true state of affairs."



Fig 1.—Appearance of nodules in buttocks region.

After his discharge from the hospital, there ensued several months during which he gradually learned to walk again although the act was accompanied by a good deal of pain.

He returned to Florida in the summer of 1930 and has gradually improved, and, although there was still a marked divergence from the normal in all of his motor actions, he was able to take care of himself, swim, throw a ball and do a little dancing act. It was still somewhat difficult for him to get up from a prone position.

The nodules first made their appearance in May, 1931 the mother stating that she noticed them shortly after Spanish fly plasters had been applied to the boy's spine by a physician. She noticed 'lumps' all over him especially in the region of the buttocks. Since their first appearance, they have grown much larger and harder though there has been very little progress in either direction during the last six months. The mother stated that there has been a marked improvement in his motor activities since their appearance.

Physical examination—Examination revealed a well-developed and well-nourished white male weighing 49 pounds. Stripped he had a peculiar appearance that may best be described as 'tightness' as though there were lacking the normal body

elasticity. The lower eyelids had a reddened appearance as though he had been rubbing them. This was persistent. He had also over the extensor surfaces of the hands a red annular rash, which came and went. There was a broken down area on the right elbow which the parents stated had been there a year, alternately breaking down and clearing up.

There were a great number of nodules scattered over different parts of the body with a decided tendency toward clumping in certain areas. This was especially marked in the axillary region, the buttocks, and the anterior surface of the neck.



Fig. 2—Roentgenogram of pelvic region showing extensive calcium deposits

Their location in regard to depth also varied, some of them seeming to be directly under, though not attached to, the skin, others lying deep in the subcutaneous tissues, and still others along the tendons. On the other hand, there were areas that seemed to be entirely free from nodule formation, in particular, over the pectoral area and the back. These nodules varied considerably in their consistency, some seeming tough and fibrous while others were bony in their hardness.

Motor activity. There was no muscular atrophy. There was an inability to flex the hand on the forearm and to extend the forearm normally in relation to the arm. The body could be bent only 45 degrees on the hips, and there was a mild

lordosis. The fingers were stiff and could not be extended normally although the grip was of average strength. There was no equinus deformity at this time. The child carried himself in a rather 'poker back' posture. There was marked restriction in opening the mouth. There were no deformities of the fingers or toes aside from the sclerodactylia. There were no sensory disturbances.

Laboratory examination —Kahn test was negative, urine, negative in all respects. Blood count did not diverge from the normal. Stool was negative for ova and parasites.



Fig. 3.—Roentgenogram of left leg.

X-rays of the shoulders, hips, neck and pelvic region showed refractile deposits in the locations mentioned on physical examination.

Permission was granted for biopsy and one of the smaller and more superficial nodules was removed from the buttocks. On removal, this nodule seemed to consist of a fibrous matrix, embedded in which was a hard, bone-like substance which would not crumble between the fingers. The pathologic report was as follows: Microscopic section through the softer portions of the nodule show no evidence of malignancy. Microscopically there is a predominance of rather dense connective

tissue associated with a few round cells and plasma cells, a considerable amount of fat, and also a large number of amyloid bodies, many of which have undergone calcification."

An attempt made to keep this child on a ketogenic diet as advocated by Kennedy¹⁶ met with no cooperation and was abandoned as was the ammonium chloride route to ketosis as used by Skossogorenko¹⁷ for the same reason. This condition remained

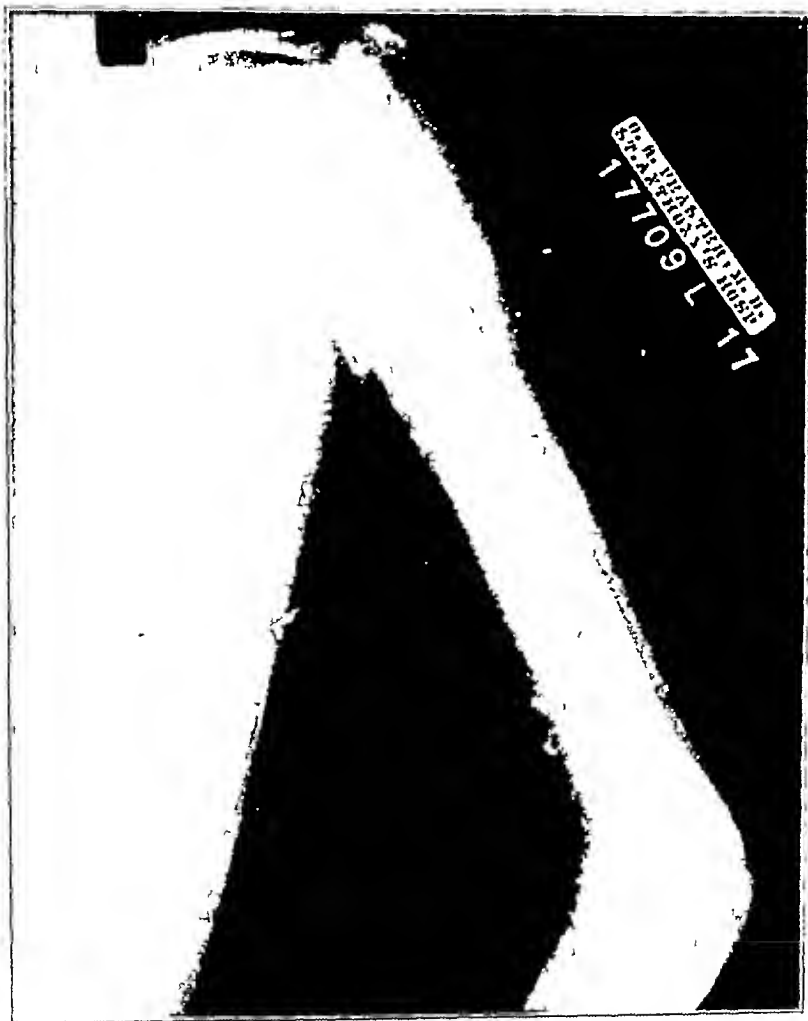


Fig 4—Roentgenogram showing calcium deposits in axillary region.

unchanged until January, 1933, when several of these areas became infected, broke down and exuded large amounts of pus, which contained chalky material, and left behind sinuses that healed with difficulty. He was ill with high fever and a good deal of pain for a period of about two months. Following this he was treated by means of medicine internally and ultraviolet light. On June 1, 1933, he was brought back to my office and showed marked improvement, many of the larger areas having disappeared and his motor activity correspondingly increased. Hein¹⁸ has recently reported a case that over a period of several years with ultraviolet treatment has

shown marked improvement. On the other hand a prolonged illness with fever perhaps produced a sufficient ketosis to influence absorption of calcium from these areas.

DISCUSSION

The similarity between this case and others reported may be shown in a brief review of a few of these cases.

Craig and Lvall's¹⁸ case began suddenly with pain, fever and swelling in February, 1926, followed by prolonged muscular weakness and the development of calcified nodules in March, 1927.

Wilson's⁷ and Derby's⁸ patient, two and one half years old, showed muscular weakness, dropped to his knees and was unsteady for six months previous to the onset of calcification.

Skossogorenko's¹⁹ patient had an acute infection with high fever in 1922. Five months later he had edema of both extremities and lost use of them. This lasted for three years at the end of which time he resumed some use of his limbs, the edema disappeared, and calcified nodules made their appearance.

Morse's²⁰ patient was sick for a week with influenza, a month later fell from a chair and soon after stopped walking. The calcium nodules were discovered some months later.

Kennedy¹ noted instability and difficulty in walking for two years preceding the onset of calcium deposits.

While all of the cases reported do not show so clear cut a sequence of events, yet there are certainly enough of them to lead us to the belief that, at least with children, the essential features are an acute illness followed by muscular weakness, which in a varying length of time is followed by calcium deposition. This idea however is not new although there still remains the question as to whether the preceding condition is one of dermatomyositis or scleroderma. These two entities are so similar to each other that there is often extreme difficulty in differentiating them. Allan¹ considered the two identical while Langmead,² Cullinan,²² and Steinfield²³ though doubting their identity admit that there is a very close relationship between the two. Steinfield's case of dermatomyositis showed sclerodermic changes and he states that this is frequently the case.

The present case however coincides so thoroughly with the excellent description of dermatomyositis as given by Karelitz and Welt⁴ and differs so from the usual description of scleroderma that we are forced to the conclusion unless the two conditions are one and the same that in this instance there was a prevailing dermatomyositis.

As to the actual pathologic process involved, there remains a great deal to clear up.

The theory of endocrine origin seems untenable in that all of these cases have shown normal blood calcium figures and the one case that has

come to autopsy, that of Durham, has shown apparently normal parathyroids, both macroscopically and histologically

That there is present a distorted calcium metabolism has been shown by Bauer, Maible and Bennett. On an inadequate calcium intake (0.286 grams per three day period), their patient showed a positive calcium balance of 0.170 grams per three-day period. Two normal boys, aged nine and fourteen years, on the same inadequate intake showed a negative balance of 0.46 grams. This same imbalance was shown to be true of phosphorus. It is likely, however, that this change of balance is the result rather than the cause of the deposition of calcium. Besides, a theory of metabolic disorder would not account for the acute onset, the prolonged muscular weakness, and the duration of time between onset and calcium deposition, or for the unquestioned improvement in this patient with the appearance of the nodules.

Durham has made some very interesting observations regarding the capillaries in scleroderma. He noted enlargement of the capillaries with the venous ends distended like bulbs and with a sluggish flow of blood, and after adrenalin injection, almost complete stasis in the smaller capillaries and marked slowing in the larger. These observations seemed especially important in view of Hofmeister's²⁵ belief that as soon as a fluid loses its free carbonic acid, provided there is no increase in the velocity in the fluid flow or a higher protein content, a deposition of calcium phosphate can occur.

Hunter²⁶ believes the condition is similar to the deposition of calcium salts in tuberculous lesions or sclerosed heart valves, i.e., an end-result of fibrosis.

Pospelow²⁷ mentioned the affinity between elastic fibers and calcium salts and believes that deposits can occur in normal elastic tissue.

While all writers on this subject, with the exception of Morse, have been unable to find evidence of fat, elastic, or connective tissue injury after calcium has been deposited, it seems highly probable that this must have occurred either from direct bacterial or toxic action or through interference with the normal circulation to these areas. It is certainly conceivable that injury to these types of tissues, none of which possess any definite organ morphology, could not be readily detected after the acute condition has cleared. That injury to the circulation does take place with dermatomyositis has been shown by Bass and Denzer,²⁸ Batten²⁹ and by Karelitz and Welt, the latter in an exhaustive pathologic report on one of their cases noted "perivascular round cell infiltration, thickening of the vessel walls, and occasional obliteration of a vessel plus involvement of the musculature of the vessel."

The simplest and most tenable suggestion as to the pathogenesis of this condition would therefore seem to be a diffuse involvement of the sub

cutaneous tissues by dermatomyositis scleroderma or a similar disease with a consequent alteration, either in the tissue itself or following in directly a vascular injury, favoring the deposit of lime salts

SUMMARY

A case of calcmosis universalis is reported with an attempt to trace its origin from a pre-existing condition which was apparently dermatomyositis

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101 FIFTH STREET SOUTH

ACHONDROPLASIA IN A TWIN

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LITERATURE is replete with reports of cases of achondroplasia, but a thorough search fails to reveal a definite case in twins. Hutchinson¹ cites one case in twins, but the pictures are poor and show very few signs of achondroplasia.

Achondroplasia, the name given to this entity by Parrot² in 1890, has been referred to by many writers as fetal rickets, intrauterine rickets, and fetal cretinism. Kaufmann³ as a result of his pathologic studies in this disease, called it *chondrodystrophia foetalis*. It is a Mendelian character (dominant) and is characterized by dwarfism, with short stout limbs, body normal, though relatively long, and head hydrocephalic in appearance.

The etiology is still the subject of controversy and surmise. Some observers, De la Torre and Allende,⁴ believe it to be hereditary and support their opinion by citing a case in which consanguinity was responsible. Thomson⁵ asserts that it is due to a definite pathologic condition during uterine life. Wheeldon⁶ observes that the changes in achondroplasia are probably due to the smallness of the amnion and that they are produced between the third and eighth weeks of intrauterine life. Durante⁷ believes that it is due to a sclerosis of the zone of the endochondral ossification. Kaufmann³ as a result of his many observations shows that there is a primary malformation of the epiphyseal cartilages and early cessation of endochondral bone formation.

The following report of a definite case in a twin is presented because of its interest and rarity in the literature.

Rosemary S., aged ten months, was brought to the Pediatric Clinic of Lebanon Hospital by her mother, who told us that she thought that this child "looked different than the other twin sister." Investigation revealed that this child was one of twins, both girls, that it was born at term, delivery had been normal, that the father was of normal height and had normal physical features, the mother of average height with normal physical features, both of average intelligence, that they were not related by blood, and that there was no similar child in either branch of the family for three generations back.

The history showed that the child had been bottle fed since birth and had all ways been well with the exception of diarrhea two months previously which lasted for several days.

On examination we found an obese well nourished child ten months old, who could not sit up and who showed a general hypotonicity of the muscles and joints. The weight was $10\frac{1}{2}$ pounds and length 24 inches. The head was very large and hydrocephalic in appearance with very prominent frontal and occipital bulges. The cir-



Fig. 1.—The well nourished achondroplastic twin with the typical faces and marked pads of fat on extremities.

Fig. 2.—Showing the large head, the short, stunted limbs and the disproportion between body and extremities.



A

B

Fig. 3.—The twins side by side. A The achondrocephalic twin. B The normal twin. (Note the length of upper extremities and their relationship to the umbilicus.)

cumference of the head was $18\frac{1}{2}$ inches, and the anterior fontanel was $2\frac{1}{4}$ inches in diameter. The face showed heavy and broad features, with a short stubby nose depressed at the bridge. The mouth presented a high vaulted palate.

The neck showed no rigidity. There was no adenopathy or palpable enlargement of the thyroid. There was slight bending at the costocervical junction of the chest. Lungs and heart were normal. The abdomen was protuberant, the hips large and fleshy. A definite lumbar lordosis was present.

The extremities were short and stubby, markedly obese, with pads of fat hanging loosely over arms and legs. The forearms were larger than the arms, and the legs, longer than the thighs, were quite bowed. The arms when extended reached about to the level of the umbilicus. The hands were quite characteristic, the fingers being short, stubby, and fleshy, and of almost equal length—the so called trident hand. The forearm measured $3\frac{1}{4}$ inches, the leg, $3\frac{1}{4}$ inches, anterosuperior spine to heel, 9 inches, tip of acromion to styloid of radius, $6\frac{1}{4}$ inches. Episternal notch, to symphysis pubis $11\frac{1}{2}$ inches. The disproportion between the body and the extremities was quite marked, and this was apparent when both twins were placed side by side.

The other twin, Elizabeth S., was normal in every respect, weighed 22 pounds and 9 ounces, length, 29 inches, she sat up well and had four teeth. The forearm measured $4\frac{1}{2}$ inches, leg, $5\frac{1}{4}$ inches, circumference of head, $16\frac{1}{4}$ inches, and the anterior fontanel, $1\frac{1}{4}$ inches in diameter. This normal twin always cried and was tempestuous in nature, while its abnormal sister was generally good natured and placid in disposition during all the examinations.

Radiologic examinations revealed no pathology in the bones of the skull. The posterior fontanel was closed, the anterior fontanel, open, and sella turcica normal. The left forearm disclosed a broadening and cup shaped deformity of the distal end of the shaft of the radius and ulna, with fraying. The right forearm showed a broadening and irregularity of the distal end of the diaphysis of the radius and ulna. All the bones of the hands appeared shorter and broader than normal. There was an absence of distal epiphysis of tibia and fibula of both legs, with an irregularity and widening of the distal ends of the tibia and fibula. X-ray pictures of the skull and long bones of the normal twin failed to reveal any abnormality. The above described x-ray findings are generally found in achondroplasia, but are usually more marked. This patient was too young to show the synostosis of the nuclei of the vertebral arches, with the resulting flattening and narrowing of the vertebral canal.

COMMENT

This case illustrates all the features and characteristics of achondroplasia and is remarkable inasmuch as it occurred in a twin. It is difficult sometimes, in the early months of infancy, especially in a very obese child, to make a diagnosis of micromelia, the characteristic feature of achondroplasia. In this case the child was seen at ten months of age, and there was the added advantage of having it presented at the clinic with its normal twin. The general puffed or bloated appearance of the child with its unusually large head makes one think of cretinism. The short extremities, the disproportion between the trunk and the extremities and the x-ray findings leave no doubt as to the diagnosis of achondroplasia, as the accompanying photographs illustrate.

The interest in this case centers around the fact that it occurred in a twin. If we assume that these twins were of the uniovular type, the difference in the physical development, according to I. A. Abt,⁸ may be assumed to have occurred as a result of an unequal division of the germ

plasm, or as in some instances, the arrested development of bone in this condition may be accounted for as result of a poor blood supply to one twin, through a long and winding umbilical cord

While many authors report no changes in the thyroid and no alteration in the physical appearance of these patients as a result of thyroid treatment still it is not unreasonable to assume that the condition may be due to some endocrine gland disturbance Wagner⁹ seems to think that the condition is influenced by some prenatal deficiency He is of the opinion that the modification of the growth of the bone may be caused by excessive gonad activity or by interaction of other endocrine glands Abels¹⁰ remarks that the condition is due to a disturbance in the internal secretory equilibrium and he shows that some changes in the thyroid, abnormal development of the genitals and overdeveloping of the muscular and digestive systems, indicating an abnormally increased productive stimulus, are often found

While the endocrine theory has been set aside by many authors as not tenable, we believe with the increased knowledge of the functions of the active principles of the endocrine glands—the hormones and chalones—we shall be able to fathom the phenomenon of achondroplasia

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BRONX PROFESSIONAL BUILDING 2021 GRAND CONCOURSE

THE EFFECT OF SMALL QUANTITIES OF BREAST MILK,
LIVER EXTRACT, IRON AND COPPER, RESPECTIVELY
AND IN COMBINATIONS, UPON THE IRON BALANCE
OF ARTIFICIALLY FED INFANTS

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KRASNOGORSKY,¹ in making iron balance determinations on breast-fed and artificially fed infants, concluded that the iron compounds of breast milk are absorbed and retained to a considerably higher degree than those of goat's milk

Langstein and Edelstein² declared Krasnogorsky's iron values were too high Soxhlet³ criticized the methods employed by Bahrdt and Edelstein⁴ and Edelstein and Csonka⁵ as being merely oxidation and reduction methods giving unreliable results Langstein and Edelstein⁶ discussed Soxhlet's attack on their methods and concluded that, fundamentally, Soxhlet obtained the very same results on the iron content of cow's milk used in the artificial feeding of infants, as they did some time before Soxhlet's publication Although Langstein and Edelstein criticized Krasnogorsky's work, their data on breast-fed infants confirmed his conclusions

In this work we have repeated and confirmed Krasnogorsky's iron balance observation on breast-fed infants and partially confirmed those on the artificially fed The studies were extended to include the effect of liver extract, copper, iron (inorganic and organic), and different combinations of these substances upon the absorption of iron from the gastrointestinal tract of young artificially fed infants

Five groups of infants were used, comprising a total of seventeen cases The four artificially fed groups each consisted of three infants of approximately the same age The data are charted as column graphs Each column represents the average per day per infant obtained for the group The red cell count is charted as millions per cubic millimeter The hemoglobin is charted in grams of hemoglobin per 100 c c of blood

The amount of iron intake per infant is the average number of milligrams of iron consumed in the formulas per day over the three-day stool collecting period

From the St. Vincent's Infant and Maternity Hospital the Otho S. A. Sprague Memorial Institute and Department of Pathology University of Chicago

We wish to thank Armour and Company for the concentrated liver extract and iron used in this experiment and the grant for the quantitative iron determinations

The iron balance is the result obtained by subtracting the average daily milligrams of iron in the stool from the average daily iron consumed per infant. When the iron in the stool is greater than the iron consumed in the diet, the balance is negative. If the iron in the stool is less than the iron consumed, the balance is positive.

Method—The total three-day stools of each infant were pooled together, dried, ignited and digested free of organic material in concentrated H_2SO_4 on the Kjeldahl shelf hastening the oxidation by repeated additions of concentrated HNO_3 . Known quantities of reagents were used and their iron content subtracted from the final determinations. The sulphuric acid digest was diluted to a known volume and an aliquot portion used for the quantitative iron determination. The iron was precipi-

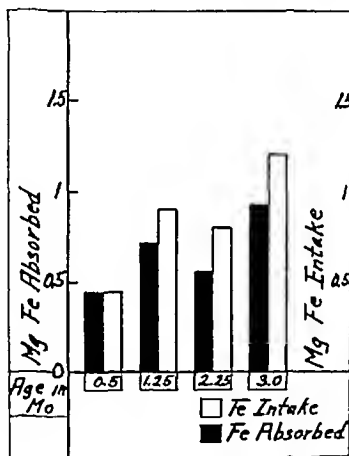


Chart 1—The average iron balance of three breast fed infants. The age of these infants was three weeks at the beginning of the experiment. The increase in iron intake was due to complement feedings.

tated from the solution by concentrated NH_4OH . The solution was heated to boiling and $Fe(OH)_3$ filtered and washed with boiling water to avoid loss by solution of the $Fe(OH)_3$, which is slightly soluble in cold water. The washed precipitate of $Fe(OH)_3$ was dissolved on the filter paper with hot concentrated HCl , and the filter paper washed free of iron. The iron solution was made to volume and a portion used for colorimetric iron determination using the method of Kennedy.

Red cells were diluted in a calibrated pipette and counted on a Bureau of Standards government-certified double-ruled Levy counting chamber.

The hemoglobin determinations were made with a Fleischl Miescher hemoglobinometer. The blood was obtained from a freely bleeding heel stab wound. The counts were always made at about the same time after feeding.

Results—The average iron balance of five breast fed infants is shown in Chart 1. These infants varied in ages during the study from two

weeks to three months. The chart shows an average of 2, 5, 3, and 4 determinations from the ages of two weeks to three months, respectively. As the infants grew older they received complementary feedings, which were richer in iron than the human milk, so that the iron intake gradually increased from 0.44 mg per day at two weeks to 1.4 mg per day at three months. On this low iron intake, the infants absorbed a good

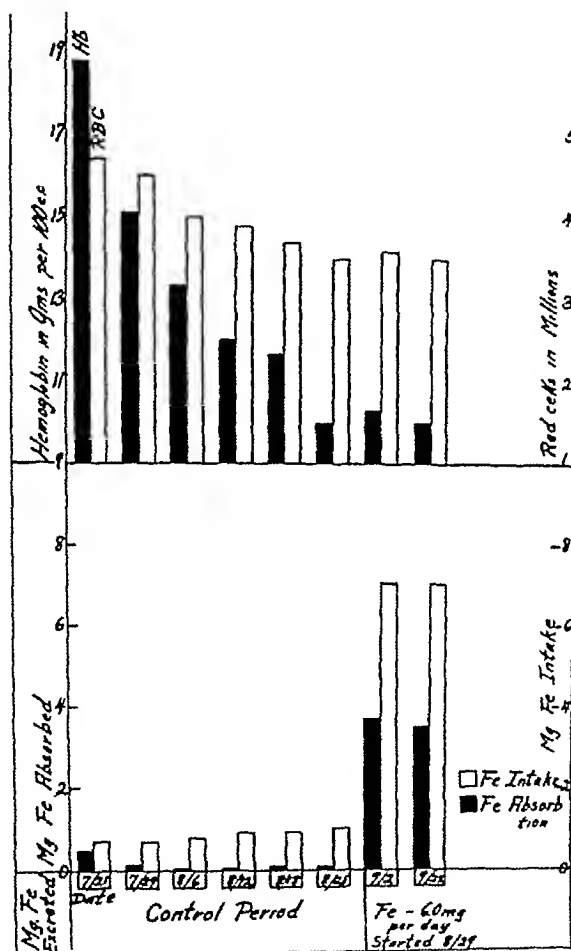


Chart 2—The average iron balance of three artificially fed infants with approximately normal blood averaging three weeks of age at the beginning of the experiment

portion of iron ranging from 100 per cent early in the experiment to 78 per cent at the age of three months when the breast milk intake was about 6 ounces daily. Snelling⁸ in a study on premature infants found an average daily positive iron balance of 0.10 mg.

The iron absorption from the gastrointestinal tract of three artificially fed infants whose blood was normal during the experiment is shown in Chart 2. The experiment was started when the infants were three weeks

old Throughout the period, a small quantity of iron was absorbed After the first week the amount of iron absorbed was of little significance when compared to that absorbed by the infants receiving the breast milk plus additional iron These infants were fed 6 mg of iron as iron ammonium citrate on and after August 29 Stool determinations made on September 2 and 22 showed a positive balance of 3.7 and 3.5 mg

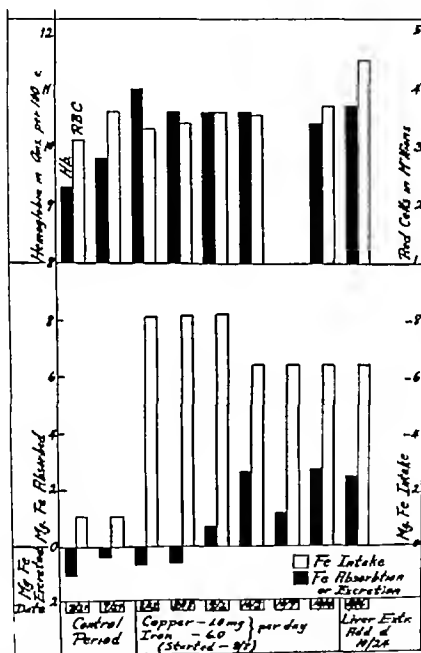


Chart 3—The average iron balance of three slightly anemic, three-and-one-half month-old infants who received copper and iron.

NOTE—In graphs number 3-4-5, when the column is charted on the excreted side of the base line the value charted indicates the quantity of iron found in the stool in excess of the intake of iron in the diet. This iron must have been derived from the body iron storage.

of iron. A little less than half of the iron consumed in the diet was absorbed and retained by the body.

Observations on the effect of copper and iron upon the iron balance of three slightly anemic, artificially fed infants were started at the age of three and a half months (Chart 3). During two periods of stool collection prior to the administration of copper and iron the infants

showed a negative iron balance of 11 and 0.4 mg. During the first three weeks of administration of the iron and copper, a negative iron balance of 0.7 mg and 0.6 mg and a positive iron balance of 0.7 mg were found, respectively. Following the administration of copper and iron, the hemoglobin maintained 0.8 gram increase even though a small quantity of iron was lost from the body storage during this period. These data demonstrate the mobilization of retained iron by copper administration, part of which was excreted by the intestines and part built into hemo-

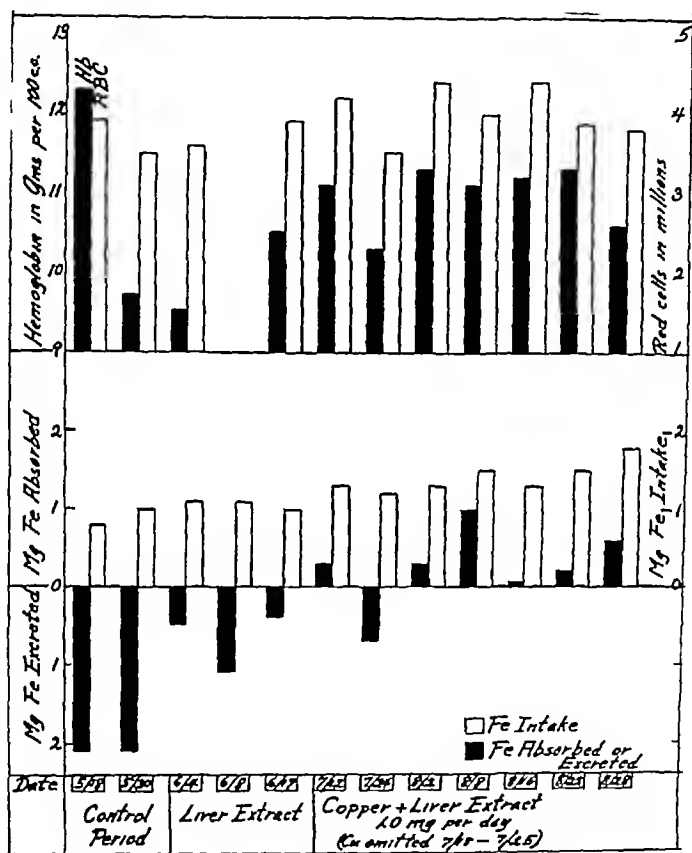


Chart 4—The average iron balance of three slightly anemic infants (averaging 2.6 months of age) who received liver extract and copper

globin. During the infants' fifth month the accompanying chart shows that an appreciable quantity of iron was absorbed from the gastrointestinal tract to support growth after the exhaustion of the retained iron. Liver extract was administered in addition to the iron during the infants' sixth month and was accompanied by an increase in red cells only.

Liver extract, and liver extract and copper, respectively, were fed to a group of three slightly anemic infants, whose average age was

two and six tenths months and average hemoglobin, 9.0 gm, and red blood cells, 3.6 millions (Chart 4). The preliminary study made on the iron balance before the experiment started showed a negative iron balance of 2.1 mg iron on May 18 and May 30, respectively. Because of the low red blood count, liver extract was started on June 3, at which time an average of 3.6 million cells and a 9.5 gm hemoglobin was found. On June 17 the red blood cells had increased to 3.9 millions, and hemoglobin to 10.5 gm. The negative iron balance had decreased to 0.4 mg. One mg of copper per day was started July 8. By July 12 the red blood

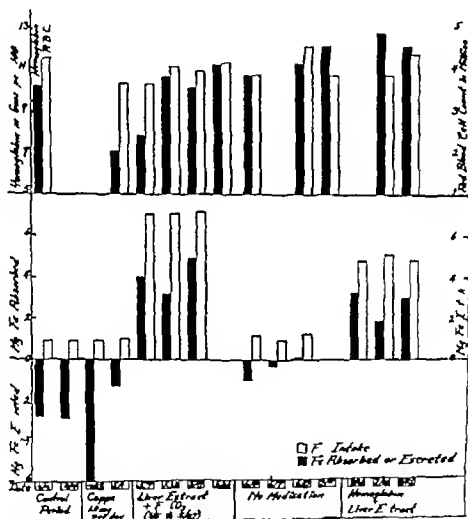


Chart 5—The average iron balance of three anemic, artificially fed infants (averaging two months of age at the beginning of the experiment) who received copper liver extract with hemoglobin.

count rose to 4.2 millions, and the iron balance became positive 0.3 mg. From July 18 to July 25 no copper was given. On July 24, six days after the suspension of copper, the red count and iron balance returned to about the same value as before the administration of copper. After August 2 the hemoglobin remained above 11 gm and RBC nearer 4 millions. By August 28 when the groups were over five and one half months old, the red blood count and hemoglobin began to drop. Undoubtedly this was due to the low iron intake and the early iron loss with exhaustion of the iron storage. The increase of the tissues through growth of the infant requires more "function iron" than that absorbed

from the digestive tract so that at this stage the blood gives up its hemoglobin iron to the tissues for "function iron." This group later gained in the R B C and hemoglobin when the iron was added. On November 5 the urine of two of the infants of this group was collected and found to contain 0.062 and 0.042 mg of iron per 100 cc, respectively. This accounts for $2\frac{1}{2}$ per cent of the iron absorbed at this time. These infants were receiving 15 mg and absorbing 12 mg.

Three anemic infants (Chart 5) were used for a study of the effect of copper, liver extract and inorganic iron (Fe CO_3), and liver extract and organic iron (hemoglobin) upon the iron balance.

Stool collection was started when the group was two months of age. The hemoglobin at this time was 10 gm and the R B C 4.3 millions. There was a negative iron balance of 2.8 and 2.7 mg on April 16 and 19, respectively. One mg of copper daily was started on April 22. There was a negative iron balance of 6 mg and 1.3 mg on April 23 and May 1, respectively. On May 1 the hemoglobin was 7 gm per 100 cc and the R B C was 3.6 millions. Copper administration was stopped on May 3. Liver extract containing iron in solution was started on May 5, continuing through May 27, during which time the hemoglobin rose to 11 gm and the R B C to 4 millions. During this period the iron balance was positive, 4.0, 3.2, and 4.4 mg daily on May 7, 13, and 19, respectively. No medication was administered from May 27 to July 18 during which time the iron balance gradually rose from negative 1.0 mg to positive 0.1 mg for determinations made on June 4, 7, and 17, respectively.

On July 18 iron was administered as hemoglobin with liver extract. The iron balance on July 21, 29, and August 12 was +3.3, +1.9, and +3.1 mg, respectively, or about one-half of the iron in the diet. The iron derived from the diet other than the hemoglobin was 1.0 mg daily. This demonstrates that infants, six months old, receiving liver extract are capable of absorbing iron derived from hemoglobin. However, the hemoglobin as a source of iron was not well tolerated by the infants as it frequently produced diarrhea.

COMMENT

The mechanism of the production of anemia in infants and the effectiveness of various agents used therapeutically has excited great interest for many years. The significance of studies on iron balance as an index of the development of anemia and of the effectiveness of a therapeutic agent is apparent. In this investigation, the iron balance of five groups of infants was studied from a number of standpoints. First, the relationship of the type of feeding, human milk, human milk plus cow's milk or cow's milk modifications was studied alone. Second, the effect of various therapeutic agents such as the additions of inorganic iron to the dietary, the effect of inorganic iron plus small amounts of

copper, the effect of liver extract alone the effect of liver extract and iron, (a) as inorganic iron and (b) as organic iron in the form of hemoglobin were observed.

TYPE OF FEEDING AND IRON BALANCE

When the only source of iron in the dietary is from the milk, a striking difference in the amount utilized in breast fed babies and those entirely artificially fed is observed. Krasnogorsky found the iron of breast milk was more available than that of goat's milk. As a result of our findings the same statement may be made with regard to cow's milk. As the infants grew older the principal source of the food was from complementary feedings of cow's milk modifications. Thus at the age of three months, these infants were receiving only 6 ounces of breast milk daily. The complementary feeding brought the iron intake up to over 125 mg per day most of which was absorbed. The addition of even relatively small amounts of breast milk appears to increase the availability of iron. This would seem to indicate some specific effect of breast milk upon the absorption of dietary iron. After breast milk was entirely discontinued the iron balance soon became negative. One group of artificially fed infants showing practically no anemia had a low positive iron balance which demonstrates that some infants do absorb the iron of cow's milk mixtures.

Kleinschmidt⁹ called attention to the relationship of the development of anemia to the amount of cow's milk in the feeding. These authors felt there was some specific toxic substance in cow's milk responsible for the production of anemia and treated such cases by the withdrawal of practically all milk and the introduction of mixed feeding with large amounts of vegetables and fruits. The data we have demonstrate the relationship of iron balance to the production of anemia and the change from a positive to a negative iron balance with the transition from human milk to artificial feeding with cow's milk mixtures. It seems likely that the development of anemia on artificial feeding with milk modifications exclusively is related to the lack of some quality of breast milk rather than to specific toxic effect of cow's milk.

ADDITIONS OF INORGANIC IRON TO THE DIET

In the group of artificially fed infants showing a low positive iron balance iron and ammonium citrate was fed in dosages yielding 6 mg of iron per day. The amount of iron absorbed by these infants before therapy was started was insignificant. After additional iron was fed, the balance became definitely positive with absorption of a little less than half the iron intake. When copper was added to inorganic iron and fed to a group of infants showing a negative iron balance during the control period the balance continued negative for the first two weeks of the experiment. Following this, the amount of iron absorbed in

creased appreciably. With the introduction of copper, a gain in hemoglobin was observed, which gain was maintained in spite of the negative balance. This may be interpreted as a demonstration of the effect of copper in mobilization of iron stores with utilization of a portion for hemoglobin synthesis and excretion of the remainder through the gastrointestinal tract. A second group fed copper alone in doses of 1 mg per day showed a negative iron balance for a two-week period during which time the hemoglobin steadily fell until a value of 7 grams per 100 cc was obtained at the end of the two-week period. Thus an increased absorption of dietary iron with copper feeding was not observed.

EFFECT OF LIVER EXTRACT

Liver extract was fed to three groups. Group 3 received it as an addition to the copper and iron feeding at the end of the experiment. This group showed a good increase in red blood cells, an increase which was maintained after the experiment was discontinued, the hemoglobin remaining about normal. Group 4 received liver extract and showed a good increase in hemoglobin while the group was in negative balance. With the addition of copper to the liver extract, the balance became positive and further gain in blood appeared. The copper was discontinued for a week, and at the end of this period, the hemoglobin had dropped appreciably, and the iron balance again became negative. When copper was again introduced, the balance again became positive with a good gain in blood, which was maintained until the infants were close to six months of age when a drop again became manifest, probably the result of the exhaustion of iron stores. Group 5 was fed a combination of liver extract and iron carbonate after a preliminary period of copper feeding, during which the blood count dropped steadily and the iron balance remained negative. When liver extract and iron were substituted for the copper, the iron balance became positive and hemoglobin and R B C steadily rose to normal levels. After a period without medication, this group was fed a combination of liver extract and hemoglobin, as a source of iron. The iron balance demonstrated absorption of the iron derived from hemoglobin. Lintzel^{10, 11} in 1928 and 1930 was unable to demonstrate iron absorption in animals when hemoglobin only was used as a source of iron. The liver extract evidently contains some element which increases the absorption of inorganic or organic iron from the gastrointestinal tract of many anemic infants.

In a study of the effect of FeCO_3 , liver extract, and the two combined, on the hemoglobin and red blood cells of artificially fed infants,¹² we showed that 30 per cent were benefited by the iron, about 50 per cent by liver extract alone, and 80 per cent by the two combined. The iron contained a trace of copper as did the liver extract. At first thought it would appear that the iron carbonate was absorbed and built into hemoglobin by the infants. This absorption of iron is shown in Chart 2. From the

infants who gained in hemoglobin from the liver extract, one can only conclude that the iron for the increased hemoglobin was derived from the iron retained after birth. This is demonstrated by the iron balance of Group 4, Chart 4, which shows an increase in hemoglobin even though there is a slight negative balance. The infants received 0.0002 mg copper in the 15 c.c. of liver extract fed daily.

CONCLUSIONS

1. Nine out of twelve artificially fed infants studied showed negative iron balances, the more severe anemias having been present in the group which had a rather high negative balance.

2. A small quantity of breast milk greatly facilitated the absorption of iron from the gastrointestinal tract.

3. In the artificially fed infants studied, copper and iron showed no more effect on the iron balance than iron alone.

4. Liver extract and iron showed the most marked improvement in the iron balance of the artificially fed infants studied, whether the iron was derived from inorganic salts or from hemoglobin.

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CONSTIPATION IN BREAST-FED INFANTS CAUSED BY ANORECTAL FISSURE

REPORT OF TWO CASES

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THE breast-fed infant receiving plenty of milk is seldom constipated, nor is the stool hard, well formed or copious. The fat, sugar, and protein of breast milk are so well absorbed that very little is wasted in the stool. The majority of cases of constipation in the breast-fed infant are of simple nature, but this fact does not preclude a careful examination of each patient with this complaint. This examination naturally includes inspection of the anorectal region and here often is found one of the common, less important, but very disturbing lower intestinal tract disorders of infants, namely anal or rectal fissure.

The stools of breast-fed infants are not large, hard or dry under normal conditions, and it seems highly improbable that such a small lesion could cause such a disturbance. The anal region is well supplied with nerves, however, and the slightest defecation at times causes extreme pain. Constipation is usually the result, and as this condition persists, the stools become larger, harder and drier, defecation becomes more painful, and a vicious cycle is present.

CASE REPORTS

CASE 1—G. B., aged four months, was brought in with a complaint of constipation of two and one half months' duration. During the first six weeks of life, the bowel movements were perfectly normal, but since that time they have been irregular and accompanied by pain as evidenced by screaming and drawing up of the thighs in a flexed position. The stools were at times copious, hard, and dry and accompanied by the passage of much gas. No blood was observed in any of the stools.

History—Full term baby, normally delivered and breast fed, no history of any acute illness, has gained well since birth, and is on a four hour interval nursing schedule, has been getting cod liver oil and orange juice for the past two months.

Examination revealed a well developed and nourished infant, weighing thirteen pounds and ten ounces. The head, neck, and thorax were negative. The abdomen was moderately distended with gas and a few small, hard masses were felt in the region of the sigmoid colon. These were thought to be masses of impacted feces. A small, red, slightly indurated area was found near the posterior portion of the anal opening, and at the base of this area a short linear tear was noted at the mucocutaneous junction. Rectal examination showed that the sphincter was rather spastic.

A bland ointment was used locally and mineral oil in small doses administered twice daily. The local redness and induration disappeared rapidly, the stools

gradually became more normal and there was no evidence of pain on defecation six days after the starting of treatment. Four weeks later the stools were perfectly normal and there was no recurrence of the constipation.

CASE 2.—M. S. aged seven months, was brought in with a complaint of constipation and colic of four months' duration. She had been well until three months of age when the bowel movements became irregular. On one occasion she did not have a movement for three days. Suppositories and enemas were resorted to and this seemed to give relief for a few days. The mother stated that she had noticed a slight excoriation near the anus and that at times the baby cried as if in pain when enemas or suppositories were used. No blood was ever noticed in the stools.

Past history.—Full term, normally delivered breast fed infant weighing 15 pounds and 14 ounces at six months of age. No history of any acute infections other than an occasional head cold. Started on cod liver oil and orange juice at two months of age and cereals at six months of age.

Examination revealed a well-developed and nourished infant weighing 10 pounds and 5 ounces. A mucoid discharge from the nose was present and the throat was slightly red. The neck and chest were normal. The abdomen was not distended and no fecal masses were palpable. Examination of the anus showed nothing externally. Digital examination of the rectum revealed a very tight sphincter. A small nasal speculum was inserted into the rectum and a rather deep fissure on the posterior surface of the rectal mucosa was observed. This fissure was about one and one-half centimeters in length and had a rather broad grey base. No blood was seen.

Lunar caustic was applied to the fissure on four occasions. Mineral oil in small doses was given by mouth twice daily. Improvement was gradual. In this case, and eight weeks after starting treatment the stools were normal. At the end of this period rectal examination with the speculum revealed a thin grey ridge at the site of the old fissure.

478 PEACHTREE STREET N. Y.

RENAL RICKETS

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THIS syndrome is sufficiently unusual to constitute a novelty when it is discovered. Most of the reports in the literature emanate from British sources. Kempson Maddox,¹ after an extensive and thorough investigation of the disorder reviewed the literature and added three new cases. Parsons² describes the roentgen appearance of the bones. The reports in this country to which reference should be made are those of Shipley³ and his coworkers, Lathiop,⁴ Swart,⁵ and Schoenthal and Burpee,⁶ who made extensive metabolic studies of a case.

Various described by different authors as renal infantilism, renal dwarfism, or nanism, renal rickets and renal pseudorickets, it is characterized clinically by a stunting of growth, associated with skeletal deformities grossly resembling true rickets. There are knobbing of the ribs, Harrison's groove, pigeon breast, knock knees, anterior bowing of the shins, and enlargement of the epiphyses. If the patient survives until puberty, there is retardation of sexual development.

Underlying these manifestations, is a serious impairment of kidney function caused by a chronic nephritis. Although a similar symptom-complex is described as a result of long standing hydronephrosis, congenital polycystic kidney, or any similar or related condition which produces serious impairment of kidney function, this article will deal with the syndrome underlying, which there is, *strictu generis*, a chronic nephritis.

Genu valgum (knock knees) is one of the most obvious symptoms and the one for which the patient usually seeks advice. The disorder is seldom discovered before the sixth or seventh year. The disease is insidious in onset and progressive in character. The renal manifestations are frequently masked by the skeletal abnormalities and are usually not discovered until the impairment in renal function has advanced to the stage of renal decompensation.

The renal part of the picture is in general that of a chronic glomerulonephritis. Polydipsia and polyuria are conspicuous symptoms. The skin is dry and coarse and often has a peculiar yellowish red tinge, not unlike bronzing. There is a tendency toward hemorrhage in the mucous membranes and skin. A secondary anemia is usually present. The blood pressure may or may not be elevated. Retinal changes related to the renal disturbance may or may not be present.

From the Pediatric Service of St. Vincent's Hospital, New York City.

The urine is pale, with fixation of the specific gravity usually below 1.010. It contains albumin in faint traces. Isolated hyaline casts and occasionally white and red cells in very small numbers are found.

In this stage of the disease where renal decompensation is present, the blood chemistry shows an elevation of the nonprotein nitrogen, urea, uric acid, and phosphorus. The calcium content of the blood is usually depressed, and there is a chronic acidosis.

The phosphate retention is apparently due to the inability of the kidneys to excrete this substance. The lowered calcium apparently occurs as a consequence of this.¹¹ A Graeme Mitchell¹² offers the theory that some of the excess phosphorus is excreted into the intestinal tract, combines there with the calcium from ingested food, and forms insoluble calcium phosphate, which is not absorbed. There is, thus, failure of calcium absorption. A negative calcium balance and true calcium starvation occur. Further as a result of impaired kidney function, there is an inadequate ammonia formation. In consequence of the failure of this important mechanism for the control of acid base equilibrium, the body is compelled to excrete fixed base in its attempt to combat and excrete the acid end products of metabolism. Among the fixed bases on which the body draws are those stored in the bones, and a general demineralization of the skeleton results.

Roentgenologically the evidence of this demineralization is seen in the extensive decalcification of the bones of the body. This is apparent from the rachitic changes in the epiphyses, rarefaction in the shafts of the long bones and similar pathologic changes in the skull, vertebrae, pelvis and other flat bones.

The terminal picture is usually uremic in nature and occurs most frequently in the second decade of life.

Pathologically, except for the osseous changes described above, the most conspicuous alterations are found in the kidneys. They are small, sclerosed, and fibrotic. There is thinning of the cortex, destruction and disappearance of the glomeruli and tubules, and extensive interstitial changes. There is frequently found an hypertrophy of the heart and occasionally sclerotic changes in the blood vessels.

There is much speculation as to the etiology. Almost all writers who have studied the condition believe it to be a primary kidney complex resulting in disturbances of mineral metabolism. The impairment in kidney function causes this. There appears to be no common factor responsible for the kidney disease. Some investigators relate its origin to fetal life and intimate renal defect arising from germplasm. Toxemia of pregnancy has also been held responsible. Syphilis has been suggested as a cause for a few of the cases. Other infections and particularly those of a streptococcic nature, like scarlet fever, have been held responsible. The persistence of previous nutritional rickets has also been suggested. Exogenous poisons, such as lead and mercury, have

been suggested and finally the endocrine glands, the hypophysis, adrenal, and parathyroids have each been investigated as a possible etiological factor

There is no consensus of opinion that any one factor will explain every case. The question of the etiology of renal rickets is obscure. The syndrome falls into the category of those diseases for which there is no definitely known cause.

Although the two cases reported here resemble those previously reported, they are, nevertheless, unique because of the fact that the patients are brothers. The familial incidence of this disease is, however, not new. A Graeme Mitchell¹⁰ infers family and hereditary predisposition to nephrosclerosis. Maddox¹ in his article notes a family history nine times in his review of the literature.

CASE REPORTS

CASE 1—The elder of these two boys of Italian parentage was nine and one half years old. He had been breast fed until the age of two years. He had never received cod liver oil or viosterol or any other antirachitic. Orange juice was not given until two years of age. Cereal and vegetable were started at eighteen months. He began walking and talking at two and one half years, but never walked well. He had always had enuresis. He drank about one and one half liters of water daily, in addition to other fluids. There was no history of previous illness. Weakness in the legs prompted the parents to seek professional advice about one month before admission to St. Vincent's Hospital. The family physician had previously referred them to an orthopedic hospital for an operation on the legs. At this hospital where the patient remained for nine days, it was decided the child was too weak for operation. (Many authors call attention to the danger of operating on knock knees because of the fact that there may be an underlying nephritis. They suggest that all such cases have a careful investigation, including a blood chemistry in order to exclude the possibility of nephritis before an operation is undertaken.)

Two days before admission to St. Vincent's Hospital, he began to bleed from the nose. Black and blue spots characterized by the mother as bruises had been noticed on the legs for about three months prior to admission. On the morning of admission to St. Vincent's Hospital, he refused his breakfast because he didn't feel well, complained of pain in the epigastrium, vomited dark red blood five or six times and bled from the nose. His breathing became heavy, and the child became stuporous, although he could be aroused.

The family history disclosed the fact that a brother had died one year previously at the age of seven years. He was characterized as an invalid who never developed properly.

Physical Examination—Examination revealed a poorly developed and poorly nourished male child said to be nine and one half years old although he did not appear to be more than five. He had the appearance of chronic illness. The skin of his face had a peculiar reddish yellow tinge. The skin was generally coarse and dry. The child was alert, looked apprehensive and worried, and asked for water constantly. His breathing was rapid and labored and gave one the impression of air hunger. The superficial blood vessels of the body were full and dilated. Notably conspicuous in this respect were the vessels at the junction of the chest with the abdomen and the vessels of the upper eyelids. The child had a distinctly female habitus, flaring hips, and knock knees. There was an elevation of the tissues over the pubis resembling a mons veneris.

The blood pressure was 98 systolic. No abnormality about the skull was noted. The eyes, including eyegrounds, were negative. Ears were normal. The mucous membranes of the mouth were pale; those of the throat were slightly congested, and tonsils were bad. The teeth were hypoplastic and carious. There was no fullness about the neck. In the region of the thyroid gland and no masses were felt in this region.

The chest was barrel shaped, emphysematous. The heart sounds were weak and lacking in muscular quality. No murmurs were heard. No enlargement was discerned clinically. The lungs were clear.



Fig. 1.—(Case 1.) Film of the upper end of both humeri shows a narrow zone of diminished density beneath the upper end of the shaft of the humerus on both sides. The trabeculations of the humerus are coarsened. The epiphyseal line is slightly cupped and irregular. The clavicles show rarefaction.

The abdomen was markedly distended, widened above and narrow below; tense and impossible to palpate satisfactorily. There was flaring of the lower rib margin.

Extremities. The legs were thin, spindly, atrophic, and showed a few ecchymotic spots. The joints were prominent and appeared enlarged.

Neurologic. The child was responsive and there was no evidence of central nervous disease. Chvostek and Trousseau signs were absent.

The breathing became rapidly worse, deep, loud, and stertorous, not unlike that due to a diphtheritic laryngitis or obstruction due to a foreign body. Locally there

was no evidence to indicate diphtheria. The nose and throat cultures were negative for diphtheria bacilli. The throat culture grew hemolytic streptococci. Bronchoscopy revealed dryness and congestion of the pharynx, larynx, and tracheobronchial tree. No evidence of foreign body. X-ray photograph was also negative for foreign body and pneumonia. There was a slight enlargement of the heart to the left. The upper epiphyses of the humeri reveal rachitic changes. Rarefaction is apparent in the clavicle. (See Fig 1.) The child died within forty eight hours of admission.

Blood Count—Hemoglobin, 68 per cent, RBC, 3,000,000, WBC, 19,950, polymorphonuclears, 86 per cent, lymphocytes, 13 per cent, eosinophiles, 1 per cent, bleeding time, $6\frac{1}{2}$ minutes, coagulation time, 7 minutes, and platelets, 59,000.

Comment No satisfactory explanation has been given for the tendency of these children to bleed. The blood counts reported heretofore have been normal except for secondary anemia. The diminution of platelets in this child is sufficient to explain the tendency to hemorrhage in this case.

Urine Report—Three separate specimens were examined. The findings were the same in each. Albumin, trace. Sediment showed a few white blood cells. Specific gravity ranged from 1.009 to 1.010.

Blood Chemistry—NPN, 125, plasma CO₂, 14 volume per cent, calcium, 5.6 per cent, phosphorus, 7.9 per cent, cholesterol, 165, chlorides, 550.

Comment Note the high NPN, the profound acidosis, the depression of the calcium and the elevation of the phosphorus. In spite of the low calcium, tetany is apparently seldom found. The absence of symptoms of tetany in such cases is explained on the basis of a relative or absolute increase in the free or ionized calcium in the serum although the total calcium may be low.^{11, 12} This increase in the ionized calcium is supposed to be a result of the acidosis,¹³ the acidosis causing a mobilization of the calcium from the calcium reservoirs of the body.¹⁴ In this instance, our figures refer to total calcium. The free or ionized calcium was not determined.

Postmortem Examination—(Dr Alexander Fraser)

The brain revealed a moderate congestion and edema.

The thyroids and parathyroids were negative both grossly and by section.

The chest revealed numerous adhesions in the left pleural cavity. Both lungs showed congestion and edema in the lower lobes with emphysema in the upper lobes.

The heart showed slight hypertrophy of the left ventricle but otherwise the heart and blood vessels were normal. There was no evidence of atheromatous changes.

The stomach wall was swollen and the mucosa was hyperemic but no hemorrhages or erosions were present. The esophagus and intestines were normal.

The liver showed toxic necrosis.

The spleen showed chronic passive congestion.

The kidneys were small and very pale in color. The capsules stripped with difficulty and left a finely granular surface. On section, the cortex was very irregular in width and the cortical markings were completely obscured by whitish and grayish spots. The whole texture of the kidneys presented a mottled grayish and yellowish gray appearance.

The adrenals were normal.

The genital organs were negative.

Microscopic Report of the Kidneys—

The glomeruli and tubules show widespread progressive atrophy with fibrous replacement. About 50 per cent of the glomeruli in a microscopic field are completely replaced by hyalinized fibrous tissue. From 80 per cent to 85 per cent of the glomeruli show some degree of atrophy and fibrous replacement. This fibrous replacement of the glomeruli appears to start in the capsule, which progressively

thickens as the glomerular tufts atrophy. The space left by the atrophy of the glomeruli is occupied by a cellular connective tissue. The distribution of this lesion is not uniformly diffuse. We see strands of relatively normal glomeruli, many of which are hypertrophied tubules alternating with strands of scar tissue including numerous completely hyalinized glomeruli, atrophied tubules, and connective tissue. The glomeruli, being closely packed together, appear exceedingly numerous. The

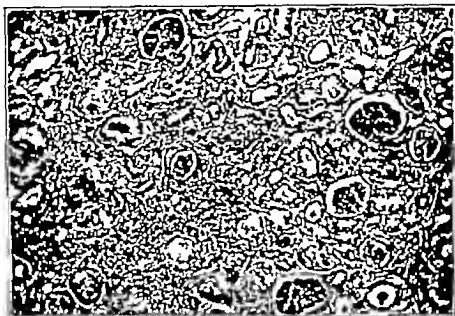


Fig. 2.—Renal scar tissue in center with hyalinized glomeruli, atrophied tubules and interstitial infiltration with lymphocytes and plasma cells. Functioning areas at right side, showing hypertrophied glomeruli and tubules at right; hypertrophied tubules at left. (Case 1.)

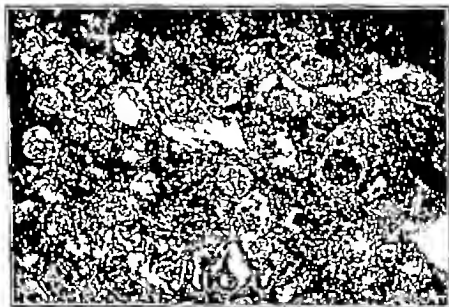


Fig. 3.—Numerous completely and several partially hyalinized glomeruli, with only one capable of function. Interstitial tissue densely infiltrated with lymphocytes and plasma cells. A few large tubules show granular degeneration, the remainder being either completely replaced by the cellular infiltration and fibrosis or markedly atrophied. The latter appear as very small tubules lined by small epithelioid cells with densely staining nuclei. (Case 1.)

medium sized renal vessels show the marks of hypertrophy. The preglomerular arterioles show a type of obliterating endarteritis which accompanies atrophy of the parenchyma rather than the hyaline deposits found in the intima in arteriosclerosis. The interstitial tissue is diffusely and rather densely infiltrated with lymphoid and plasma cells, presenting the histologic picture seen in so-called acute interstitial

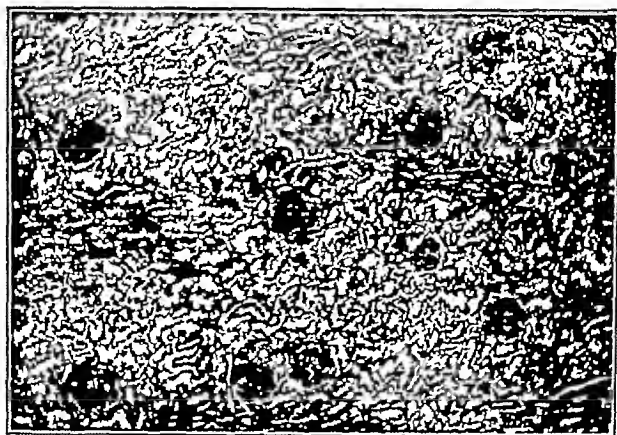


Fig 4 —Normal kidney

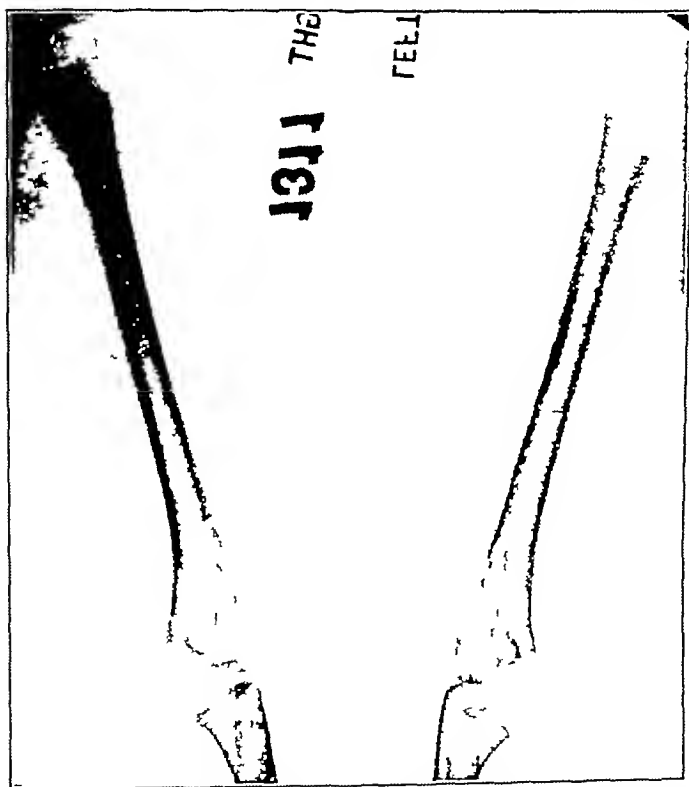


Fig 5 —(Case 2) There is an area of diminished density in the upper third of the right humerus which looks like a small bone cyst. Just beneath the epiphyseal line at the upper end of both humeri is a zone where the shaft is narrower and where the architecture is peculiar. The architecture of the lower third of the humerus is coarsened and shows decalcification.

nephritis commonly found in children. Although we are not familiar with a chronic form of this type of interstitial nephritis, it is quite possible that this case might be classed as such.

Figs 2 and 3 are sections of the kidney of this case. Fig 4 is a section of normal kidney for comparison.

Comment. The data in this case clinical history and physical findings x ray pictures urinalyses, and blood chemistry place this patient in the category of a renal rickets. The autopsy corroborates the diagnosis.

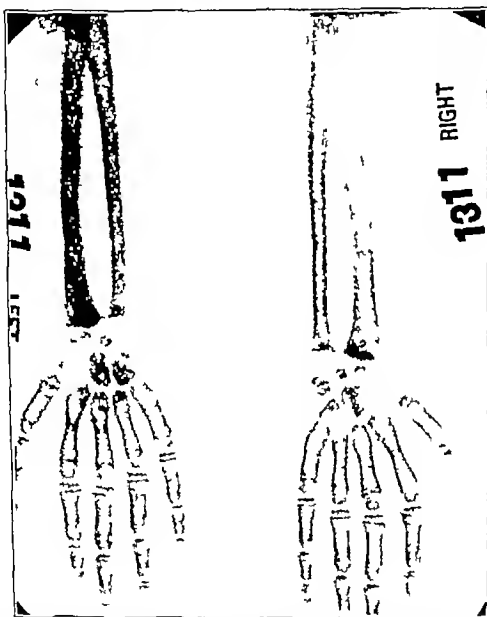


Fig. 6.—(Case 2.) The lower end of the ulna on both sides is cupped and shows a double line. The ulnar side of the lower end of the radius is slightly cupped and shows an abnormal calcium deposit in the cartilage appearing as lines of increased density radiating downward. The architecture of the bones of the forearm is slightly coarsened and there is evidence of decalcification. Both hands show a rather marked decalcification of the metacarpals and phalanges with thinning of the cortex and coarse irregular striations. The distal ends of the second, third fourth and fifth metacarpals appear cupped and a little shaggy.

CASE 2.—The younger child aged six years, was brought to the dispensary three weeks after the death of his older brother. The complaint was poor appetite and bedwetting. He had always had nocturnal enuresis. He was breast fed for ten months orange juice was started at two months. He was given cereals and vegetables when he was twelve months old. At ten months of age, he was given Scott's emulsion 1 teaspoonful, three times daily for one year. Other than this no

antirachitic was given. He had a history of measles and bronchitis and pneumonia at five months of age. He also had otitis media, cervical adenitis, and occasional colds. For the past two years, the child had been failing. He had poor appetite, was weak and pale, drank a great deal of water, voided frequently, and wet the bed.

The physical examination revealed a pale, somewhat stunted child, who was fairly well nourished but poorly developed. He seemed to be active, happy, and bright.

The head, eyes, including eyegrounds, ears, and nose were negative. The mouth

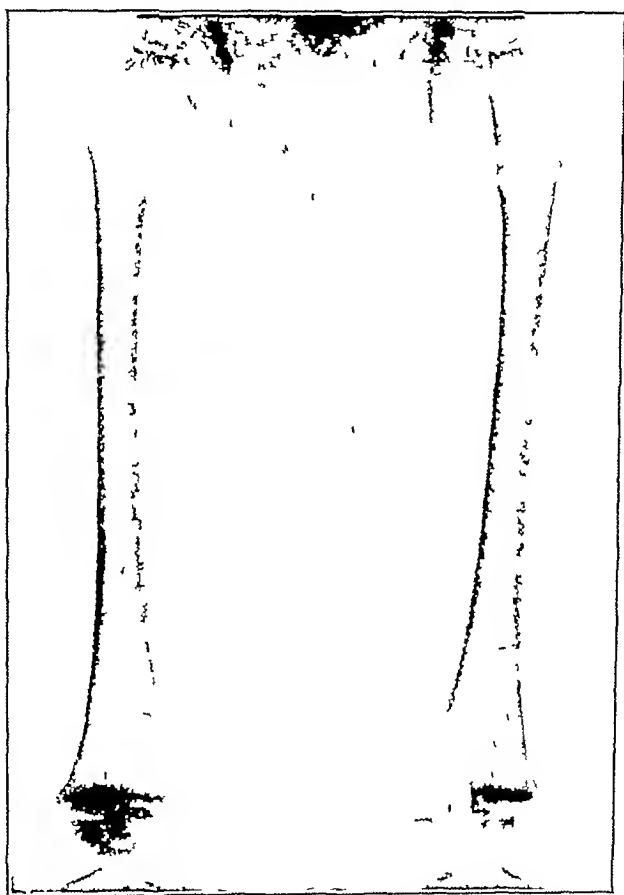


Fig 7—(Case 2) The bone of the neck of both femurs is more dense than the bone of the shaft, and is irregular in density. The epiphyseal line is irregular and there is decalcification just beneath its margin. There is evidence of decalcification in the shaft of the femur.

revealed pale mucous membranes, coated tongue, and carious teeth. The tonsils were negative.

The chest was symmetrical with a funnel-shaped depression over the sternum, Harrison's groove, flaring of the ribs, knobbing at the costochondral junctions. The lungs were clear, and the heart was negative. The abdomen was protuberant. An umbilical hernia was present. There were no palpable masses in the abdomen. Liver and spleen were negative.

There was an increase of the suprapubic fat.

Genitals were negative

The musculature was weak and flabby

The extremities were slender and atrophic. There was anterior bowing of the shins, slight knock knees and flatfeet. He stood with slight flexion at the knees

Neurologic examination was negative.

Blood pressure was 102/54

Measurements: Length 40¼ inches (17 inches—vertex to umbilicus, 23¼ inches—umbilicus to feet) circumference of head, 20¼ inches, circumference of chest 20½ inches, circumference of abdomen 17¼ inches, weight 37 pounds. The

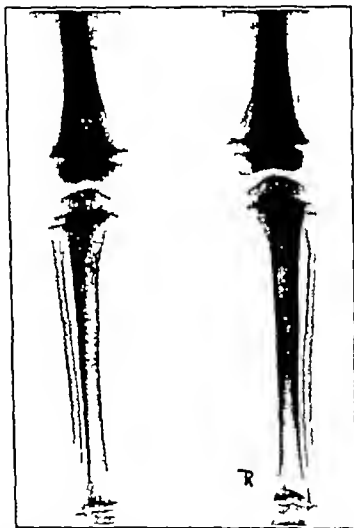


FIG 8—(Case 2.) The tibia and fibula show a slight generalized decalcification with coarsening of the trabeculae. The lower end of the shaft of the fibula on both sides is slightly but definitely cupped. The zones of preparatory calcification of the lower ends of the tibia and fibula are slightly widened and quite irregular along the epiphyseal margin producing a shaggy appearance. The appearance of the lower end of the femur is similar. The upper epiphysis of the tibia is shaggy but less marked than in the femur and the lower epiphysis of the tibia and fibula. At the upper end of the right fibula is an oval area of diminished density which looks like a bone cyst. A smaller but similar spot is seen in the upper end of the left fibula.

child was somewhat short for his age, six years. (The dwarfism becomes more apparent with increasing age.)

Tuberculin reaction was positive Schick, positive

In view of the fact that this child resembled his brother in history and physical findings, a blood chemistry complete x-ray of his skeleton, and urinalysis was ordered. This investigation was rendered somewhat difficult because it was necessary to secure the data in the dispensary the parents having refused admission to the hospital.

Urine Specific gravity, 1.003, albumin, trace, sugar, negative, sediment, showed an occasional white blood cell

Blood chemistry (May) was as follows NPN, 60.4, plasma phosphorus, 11.3, chlorides, 550, calcium, not done

The blood count showed a mild secondary anemia and a 7 per cent eosinophilia, but was otherwise negative

The x-ray findings were of interest and showed rachitic changes in the epiphyses and widespread evidence of decalcification throughout the skeleton (Figs 5, 6, 7, and 8) The x-ray topography is consistent with a mild grade of renal rickets. In some places it appears that repair had taken place of a process which might have been worse some months ago. The story of this syndrome over a period of years may well be periods of exacerbation and remission, in which, during the periods of remission, there is better excretion of the phosphorus and better absorption of the calcium. The cystlike changes in the bones are of interest. We believe that parathyroid disease can be ruled out because of the low calcium, 8.7 mg per 100 cc.

The child was placed on 30 drops of viosterol once daily. He returned after five weeks.

The blood chemistry was repeated in July and is as follows NPN, 54.1, urea, 32.4, uric acid, 6.1, creatinine, 2.0, chlorides, 570.0, sugar, 101.0, cholesterol, 250.0, plasma CO₂ C P, 32 volume per cent, plasma albumin, 5.78, plasma globulin, 1.97, plasma phosphorus, 6.6, serum calcium, 8.7

COMMENT

There is very slight reduction in the NPN from five weeks previously. The cholesterol is elevated slightly. Extreme degrees of lipemia are reported in this condition.² The child has acidosis, the phosphorus is elevated, the calcium is below the range of normal. During five weeks of viosterol therapy, the phosphorus decreased from 11.3 to 6.6. It is not known what the calcium was before antirachitic therapy. It was very likely low when compared with the phosphorus.^{2, 11, 12} The chemistry suggests improvement following viosterol therapy, but there was x-ray evidence of repair before viosterol therapy was begun. One can not say the improvement in chemistry in this instance was due to viosterol therapy. Most authors claim that antirachitics have no effect on this condition but Givory¹⁰ claims a cure of this condition in one out of three cases following the use of vigantol (viosterol). Karelitz¹¹ case is suggestive, but not conclusive. On purely theoretical grounds, one should not expect improvement from this form of therapy.

Lack of cooperation on the part of the parents interrupted further investigations on this child. We believe that clinical history, the x-ray findings, blood chemistry, and urinalyses furnish us with sufficient data to place this patient in the category of a renal rickets. The pathology in the underlying kidney condition is a matter of conjecture. By analysis, however, we venture the belief that the kidney pathology is not dissimilar from that of the older brother.

RÉSUMÉ

The syndrome called renal rickets is described. We report two instances in brothers, nine and one half and six years old, respectively.

The former is accompanied by an autopsy protocol. We emphasize the importance of a careful investigation of all children with knock knees.

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103 EAST SEVENTY-FIFTH STREET

REPORT OF THREE CASES OF CONGENITAL HEART-BLOCK WITH A RÉSUMÉ OF THE LITERATURE TO DATE

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IN 1929 Yater¹ reviewed the literature on congenital heart-block and collected thirty cases. He discarded many cases in which he regarded the diagnosis as unjustified and suggested that this diagnosis should be made only in cases in which heart-block was demonstrated by electrocardiographic examination, in which a slow pulse had been noted at an early age, and, in which there was no history of rheumatic fever, chorea, diphtheria or congenital syphilis. At about the same time Davis and Stecker,² reviewed the literature and added one more case of complete heart-block. The case of partial heart-block reported in 1929 by Nicolson, Shulman and Green³ was not included in Yater's series. Brandenburg,⁴ Anderson,⁵ Leech,⁶ Selai,⁷ and Koenen⁸ have each reported a case of congenital complete heart-block. Maude Abbott⁹ in a recently revised article on congenital heart disease mentions a case of partial block reported by Baumgartner and Abbott,¹⁰ and in the same article, a case of complete block from Moffatt's service, as yet unpublished, is described. These make thirty-nine cases recorded which, with the three reported here, bring the total to forty-two.

Postmortem studies have been published in only four cases. Wilson and Grant¹¹ reported the pathologic findings in a fourteen-month-old infant with partial heart-block cyanosis, and clubbing. The autopsy showed complete atresia of the root of the pulmonary artery with a large patent ductus arteriosus in a trilobulate heart. On the posterior wall of the common ventricle was a rounded muscular prominence, a rudiment of the interventricular septum. Histologic studies showed the auriculoventricular bands "reduced to a number of fine strands which pursue their course encased in dense fibrous tissue."

In Yater's case¹ there was reported incomplete heterotaxy with complete separation of the auriculoventricular node from the bundle of His. Perotti's case showed complete absence of the membranous portion of the interventricular septum, the right auricle communicated with the left ventricle. In this instance no histologic data are given. Maude Abbott mentions a case of congenital complete heart-block from Moffatt's service in which the heart "presented a remarkable combination of displaced left auricle, transposition of the great arterial trunks, double mitral ostium, cor biatriatum trilobulare, with right conus stenosis and congenital pul-

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TABLE I*

CASE	AUTHOR	SEX	AGE WHEN PROVIDED	AGE WHEN SLOW PULSE FIRST NOTED	PROBABLE MAL-FORMATION	CARDIAC ENLARGEMENT	GRADE OF BLOCK	SLOWEST VENTRICULAR RATE	CYANOSIS	OTHER OBSERVATIONS
31	19 8 Davis and Stecker 1928	M	13 mo	13 mo	Interventricular septum defect	Moderate	Complete	47	None	No symptoms
32	Brandenberg 1929	M	12 mo	10 mo		Moderate	Partial varying 3 1 2 1, 4 1	48	Slight at times none	At no attack of coughing with cyanosis and syncope
33	Nicolson, Shulman, and Green	M	7 yr	1 yr	Patent Interventricular septum	Marked	Complete	48	None	At 7 yr one attack of syncope
34	19 9 Anderson									
35	19 9 Baumgartner and Abbott									
36	1939 Leach	F	8 1/2 yr	4 1/2 yr	Patent ductus arteriosus / patent interventricular septum	Moderate	Complete	48	None	
37	Sclar	M	14 yr 8 mo	4 yr		Moderate	Complete	48	None	Right ventricular preponderance
38	Koenen	M	9 mo	9 mo		Slight	Complete	52	None	
39	Moffatt's (from Nelson)		20 yr		Multiple		Complete		Present	
40	Author's case	F	9 yr	9 yr	Interventricular septal defect	Marked	Complete	48	Very slight	
41	Author's case	M	5 yr	4 yr	Interventricular septal defect	Marked	Complete	44	None	
42	Author's case	F	3 yr	3 yr	Interventricular septal defect	Moderate	Complete		None	Frequent Adams Stokes attacks and death during one

The first thirty cases are recorded by W. M. Yater Am. J. Dis. Child. 23: 11-19 '33 These are the cases reported since that time.

monary arteriovenous aneurysm." It will be noted then, that the four autopsy reports in the literature show this condition to be dependent upon a developmental defect of the auriculoventricular bundle rather than upon a fetal endomyocarditis.

This report is concerned with a brief description of three cases of complete heart-block believed to be congenital. One of the children (in Case 3) had frequent Adams-Stokes attacks and presumably died in an attack of syncope. The other two (in Cases 1 and 2) appear to be normal and have no symptoms of heart disease.

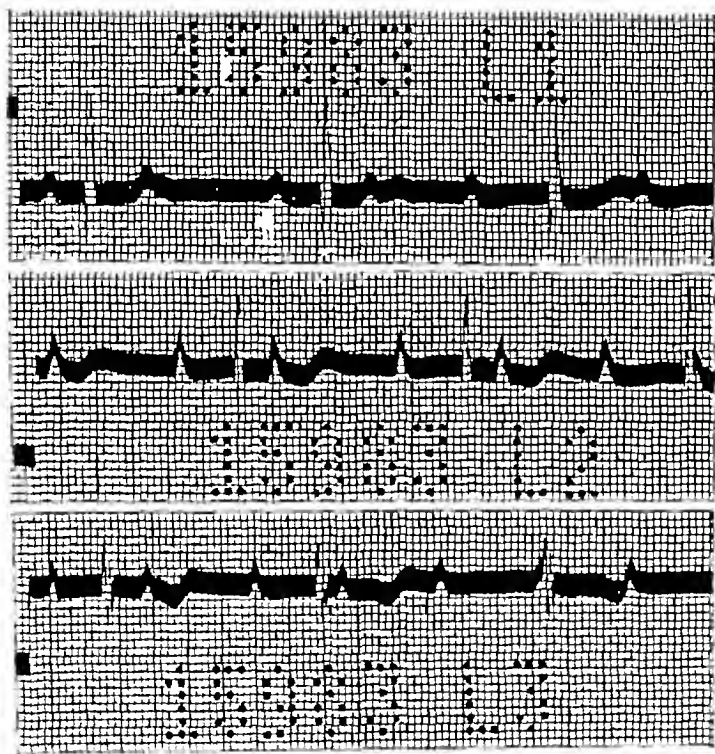


Fig 1—Complete heart-block, ventricular complexes of the supraventricular type, splintering of QRS in Lead III, and an auricular arrhythmia.

CASE 1—This patient, a girl, nine years old, was brought to the hospital in October, 1931, for examination as to the possibility of a tuberculous infection because her father died of this disease six years before. Her parents had been told that her heart was very slow during an attack of pneumonia when she was six months old, but she had never been cyanotic nor experienced dyspnea or edema. She had been normally active for her age.

The patient was fairly well nourished and well developed. The heart was definitely enlarged, a heaving apex beat was felt in the fifth left interspace, 2 cm. outside the nipple line and 10 cm. from the midsternal line. There was a distinct diastolic thrill over the fourth left costal cartilage. On auscultation a very loud, harsh, prolonged diastolic murmur was heard best at the fourth left costal cartilage. Higher up, at the second costal cartilage, this murmur became blowing, and it could also

be heard nearly to the apex but lost its harsh character there. Along the left border of the sternum there was a harsh systolic murmur, loudest in the second interspace. The heart rate was 48 per minute. The systolic blood pressure was 110 mm. of mercury, the diastolic 65. A definite capillary pulse was seen. The remainder of the physical examination showed nothing definitely abnormal.

The clinical diagnosis was complete heart block congenital heart disease with a probable defect in the ventricular septum.

Laboratory Findings—The routine examination of the blood showed nothing abnormal. The Kahn test was negative. A roentgen examination of the chest showed gross cardiac enlargement with reduplication of the upper portion of the retrocardiac

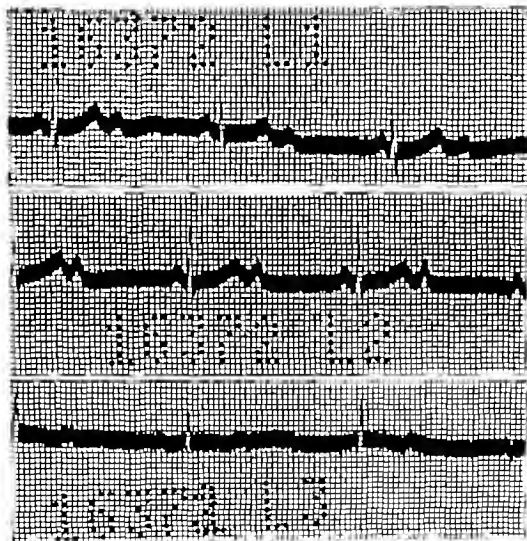


Fig. 1.—Complete heart block, ventricular complexes of the supraventricular type, and an auricular arrhythmia.

space corresponding to the location of the anricles and an increase in the transverse diameter of the heart shadow suggesting a slight preponderance of the left side.

The electrocardiogram taken October 19 1931 is reproduced in Fig 1. It shows complete heart block with an auricular rate of 112 per minute and a ventricular rate of 47 per minute. The ventricular complexes are of the supraventricular type and are normal except for an unusual amount of splintering of QRS in Lead III. There was a distinct auricular arrhythmia, the auricular cycles which contain a ventricular beat tend to be shorter than the others. The auricular complexes are normal in outline.

Reexamination on April 27, 1932, showed a heart rate of 48 while quiet, 52

after exercise. On auscultation a diastolic and a systolic murmur were heard best along the left border of the sternum. The electrocardiogram was identical with that previously taken.

CASE 2—The patient, a five-year-old boy, came to the hospital on January 14, 1932. There was a history of pertussis, varicella, pneumonia, and frequent attacks of tonsillitis. His heart had been examined during the attack of pneumonia two years before by his home physician, who had mentioned no abnormalities. In May, 1931, however, an examination was made by a school physician who told his parents that he had a slow pulse and an abnormal heart. He had been kept in bed or on

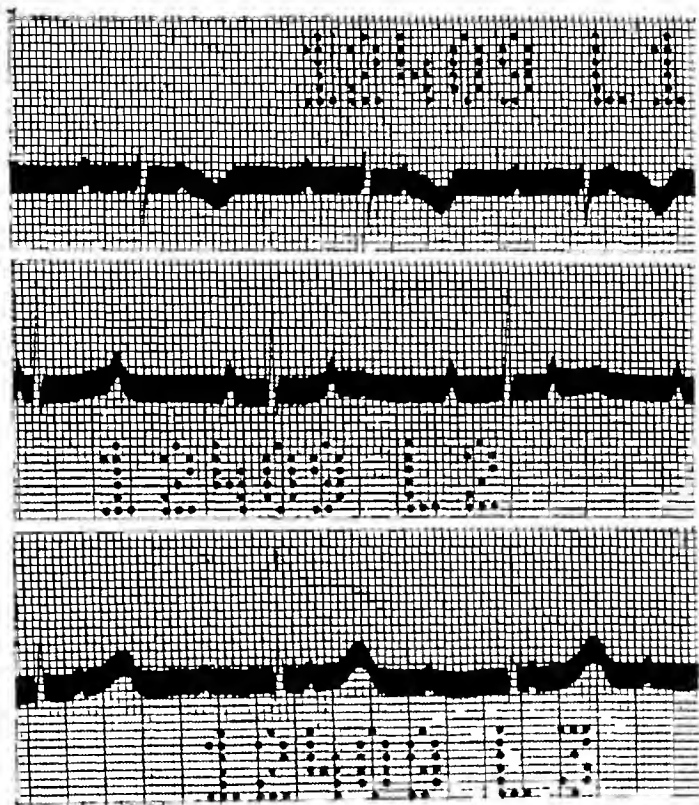


Fig. 3—Complete heart-block, ventricular complexes of the supraventricular type with moderate right axis deviation, inversion of T-wave in Lead I and an auricular arrhythmia.

limited activity since that time. A poor appetite was the chief symptom noted by the parents. Neither cyanosis nor dyspnea had been observed.

The patient was well nourished and well developed. The heart was definitely enlarged. The left border of cardiac dullness was 8 cm. from the midsternal line in the fifth intercostal space and the right border, 2 cm. The heart rate was 44 per minute, the rhythm regular. On auscultation a systolic murmur was heard in the midprecordium, loudest near the apex and along the left border of the sternum, and faintly heard in the back. It was transmitted to the carotids. There was a short, rough, early diastolic murmur at the apex. There was no cyanosis, clubbing, edema, or dyspnea. The systolic blood pressure was 108 mm. of mercury, the di-

astolic was 14 mm of mercury. The remainder of the physical examination and routine laboratory tests showed nothing abnormal. The Kahn test was negative.

The clinical diagnosis was complete heart block, probable congenital heart disease with interventricular septal defect.

The electrocardiogram taken January 13 1932, is reproduced in Fig 2. It shows complete heart block with an auricular rate of 91 per minute and a ventricular rate of 47 per minute. The ventricular complexes are of the supraventricular type and are normal in outline. There is an auricular arrhythmia similar to that seen in Fig 1.

The patient returned to the clinic every two months. He has gained in weight and his general condition is very good. The heart and electrocardiogram remained the same. He was allowed normal activity.

CASE 3—The patient, a girl aged three years, was brought to the University Hospital on September 27 1930. Nothing abnormal was noted by the family physician at the time of her birth but her heart rate was said to have been slow always. In 1928 she fell and was unconscious for two hours. She had never been cyanotic and had had no acute infections. About three weeks before coming to the hospital she had several attacks of pain with convulsions after eating pop corn. A physician who saw her in one of the attacks stated that she became stiff her eyes rolled up and her face became pinched and drawn. There were no convulsive movements. Her pulse is said to have disappeared completely. Artificial respiration was administered. The attack did not last more than two or three minutes. Her face was deeply cyanosed during the last part of the attack. The pulse was usually about 61 per minute. Belladonna had been given but had not increased the pulse rate.

On examination the heart was definitely enlarged. A loud systolic murmur and a short rough diastolic murmur were heard at the apex. The systolic murmur was equally loud at the base. The auricular sounds could not be clearly heard. There was no cyanosis. The rest of the physical examination was entirely negative.

The clinical diagnosis was complete heart block with Adams-Stokes attacks, congenital heart disease and ventricular septal defect.

The electrocardiogram showed complete heart block with an auricular rate of 112 per minute and a ventricular rate of 50 per minute. The ventricular complexes are of the supraventricular type. They show moderate right axis deviation and there is marked inversion of the T-deflections in Lead I. A distinct auricular arrhythmia of the type previously mentioned was present.

According to the patient's physician, Dr. E. R. Robbins of Detroit who has been good enough to supply us with information regarding the outcome she continued to have Adams-Stokes attacks, and was usually revived by vigorous stimulation of the anal sphincter. Death occurred in January 1931 presumably in one of these attacks but no physical was present. No autopsy was obtained.

COMMENT

Table I is a compilation of the cases recorded since Yater's report and is a tabulation similar to the one of White, Eustis and Kerr.¹ This table also includes the writer's three cases.

It is my impression that all of these cases should be considered examples of congenital heart block. All of the patients appeared to have congenital heart disease and the most probable defect in each instance was an imperfect ventricular septum. This diagnosis was based on the presence of enlargement of the heart with a loud systolic and a

short, rough diastolic murmur, best heard in the midprecordium, but without cyanosis. It would seem probable that this lesion is likely to be associated with imperfect development of the atrioventricular conduction system. We regard the association of complete heart-block with the lesion as strongly suggesting that the conduction defect is congenital rather than acquired. In all three cases a slow pulse was noted at an early age and in all there had been no other condition to which heart-block might be attributed with the exception of frequent attacks of tonsillitis in Case 2.

Adams Stokes attacks are apparently not particularly uncommon. There were nine cases showing these attacks among the thirty-nine cases of congenital heart block that have been recorded. Many of these patients experienced no symptoms of heart disease.

In all of our cases the ventricular complexes of the electrocardiogram were of the supraventricular type indicating that the conduction defect lay above the bifurcation of the His bundle and that the two main branches of the His bundle functioned in a normal way. The ventricular rate was higher than is usual in complete heart-block in adults, and auricular arrhythmia was conspicuous.

In the absence of Adams Stokes attacks congenital heart-block probably produces no symptoms and does not tend to shorten life. The prognosis depends upon the associated lesion.

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706 MEDICAL ARTS BUILDING, TULSA, OKLA

LYMPHANGIECTASIS WITH CHYLORRHEA

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THE consideration of conditions which may result from obstruction and dilatation of the peripheral lymph vessels, apart from elephantiasis leads naturally to recording unusual and rare conditions of less clinical importance. Few cases of lymphangiectasis with chylorrhea have been reported during the past two decades. In spite of the apparent rarity of the clinical condition, it is difficult to believe that cases similar to one about to be reported have not been observed in this country.

CASE REPORT

J. S., a colored boy eleven years old, was seen on July 9, 1931, with the complaint of swelling of the upper part of the left thigh and an intermittent milky white discharge from some small vesicles in the left groin. The mother stated that the child was in good health until about one year before entrance when he told her his left leg was wet. Upon examining the patient she found a milklike fluid coming from a small vesicle on the left groin. The left thigh seemed larger but the patient experienced no pain. The swelling of the thigh and drainage have occurred spontaneously and periodically since that time. The intervals were irregular, varying from days to months. For the past few months the thigh has remained swollen and drainage has occurred with greater regularity. The vesicles in the left groin would rupture and discharge a characteristic milky fluid upon the slightest trauma. The mother volunteered the observation that the swelling in the thigh is less marked in the morning before arising and the drainage of the milky fluid is increased by the ingestion of candy and decreased after castor oil catharsis. No pain or discomfort has been noted at any time.

Past History—Measles at four years, mumps at six years, repeated attacks of tonsillitis for the past few years. History is otherwise uneventful.

Family History—Father's whereabouts unknown. Mother has had two miscarriages after patient was born. No history of tuberculosis was obtained.

Physical Examination.—The patient is a fairly well-nourished boy. Positive physical findings consisted of a moderate generalized lymphadenopathy and an obvious disproportion in size of the lower extremities. The upper third of the left thigh was distinctly larger than the right. The left inguinal region was fuller than the right and several discrete millet seed sized vesicles, filled with a whitish fluid, were noted in the skin. On the inner aspect of the left thigh the perineum and

	RIGHT LEG		LEFT LEG	
	7:30 A.M.	7:30 P.M.	7:30 A.M.	7:30 P.M.
Mid thigh	35.5 cm.	36.1 cm.	37.1 cm.	38.0 cm.
Mid-calf	23.6 cm.	23.9 cm.	25.2 cm.	26.3 cm.
Ankle	16.6 cm.	17.8 cm.	19.8 cm.	20.6 cm.

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the left side of the scrotum up to the raphe the vesicles were more numerous and smaller. While the left leg was larger than the right, no definite change was noted in the daily measurements upon arising and retiring.

One of the larger vesicles in the groin was punctured, and a milklike fluid continued to drain. The rate of flow was not grossly altered by standing, lying down or by elevating the leg. Several ounces of fluid could be collected before the drainage



Fig 1—Photograph showing drainage of chyle from dilated lymph space located on the lateral aspect of the left leg. On the medial aspect is a group of dilated lymph spaces filled with chyle.

ceased spontaneously. The fluid was thin, milk white, and opaque. It clotted in from 5 to 10 minutes, when collected in a test tube. The clot was soft and non-retractile. Microscopic examination of the fluid revealed lymphocytes, a few red cells, and free fat globules. Culture of the fluid gave no growth.

Because the fluid in the vesicles was suspected of being chyle, an attempt was made to study the composition and drainage after a high fat meal. The following results were obtained after a meal at 12 noon:

		CHOLESTEROL	FATTY ACID	LECITHIN
1st specimen	1 30 P M	53 mg	149 mg	7 5 mg
2nd specimen	3 30 P M	57 mg	179 mg	10.8 mg
3rd specimen	5 30 P M	76 mg	159 mg	8 7 mg

Laboratory Data—

Urine	Negative		
Blood	Hemoglobin	0% (Sahli)	
	Red Blood Count	4 800 000	
	White Blood Count	6 800	
	Differential		
		48% polymorphonuclears	
		33% lymphocytes	
		17% monocytes	
		2% eosinophiles	
Serology	Blood Wassermann and Kahn	4 plus	
	Spinal fluid Wassermann and Kahn	negative	
	Fluid from the vesicle	4 plus.	

COMPARATIVE CHEMISTRY OF THE BLOOD AND FLUID FROM THE VESICLE

BLOOD		FLUID FROM THE VESICLE	
Sugar	98.0 mg	Sugar	114.0 mg
NPN	31.0 mg	NPN	20.6 mg
Chlorides	0.0 mg	Chlorides	580.0 mg
Calcium	9.0 mg	Calcium	8.8 mg
Phosphorus	15.0 mg	Phosphorus	7.24 mg
Potassium	19.8 mg	Potassium	18.6 mg
Cholesterol	263.0 mg	Cholesterol	53.0 mg
Serum albumin	4.2%	Total protein	3.87%
Serum globulin	1.8%	Albumin	2.88%
CO ₂	64.0	CO ₂	58.0
P _H	7.47	P _H	7.28

Tuberculin Mantoux Test, negative

X-ray examination of the gastrointestinal tract and abdomen Negative

The clinical course of the patient was uneventful. No fever was present at any time during the observation, and the patient was in an apparently good state of health. Biopsy of one of the vesicles was undertaken. A milky fluid draining profusely from the biopsy wound was eventually controlled by pressure. Histologically, the vesicle was a dilated lymph space without any pathologic infiltration or proliferation of tissue. Although the patient presented no other clinical evidence of syphilitic infection other than generalized lymphadenopathy and positive serology until syphilitic treatment was instituted. After three complete courses the serology remained unchanged. No changes in the left groin were observed.

The patient was under observation for two years and then moved to a different city. Returning to Chicago on July 27 1933, he was readmitted to the hospital. During his absence the chyle ceased draining from the groin however the entire left leg increased in size and chyle drained from the ventral surface of the foot. The vesicles on the scrotum increased in number but were not distended with chyle as they had been on his previous entrance. Because of the progressive character of the patient's illness, an exploratory laparotomy was decided upon. Upon opening the abdomen the mesentery was found to be studded with enlarged lymph glands especially marked about the small intestine. No other pathology was noted. A few glands were removed for histologic study and on section showed changes characteristic of a chronic lymphadenitis.

DISCUSSION

The causes of lymphangiectasis with chylorrhea are not definitely known. Numerous theories are offered to explain the condition. The most prominent hypotheses are those of Haferkorn,¹ Neumann,² and Ning.³ The first author advanced the idea of a congenital defect in the anlage of the lymph spaces with subsequent dilatation due to stasis and congestion. Neumann,² however, believed that clinically and histologically this theory could not be substantiated. The author held to the idea of an abnormal communication with the lymph vessels of the thigh and chylous vessels on the same side. As most cases occur at about the time of puberty, the increase in blood pressure, incident to that period of age, raises the lymph pressure. The combination of increased pressure and a congenitally weak lymph vessel causes it to dilate. The explanation of the predilection for the occurrence on the inner side of the thigh and genitals is that the lymph spaces in this region are thinner, more superficial and more abundant. Hence, dilatation would be more likely to occur in these areas. Ning,³ in a recent article, supports the idea of back pressure and congenital communication with the chyle vessels and lymph vessels of the thigh. He reports a patient who was very carefully studied and observed for a period of twenty-three years and in whom no change in the clinical condition was noted, except for an increase in the number of lymph cysts. It would seem to be more than a passing coincidence that in most of the cases reported, either syphilis or tuberculosis has been present. However, it is difficult to believe that this alone is sufficient to explain the condition. The number of cases of lymphangiectasis with chylorrhea are too few in number to be ascribed to such a common etiology alone. No postmortem studies are available, and rarely has it been possible to test the various theories clinically. Until conclusive evidence is presented, it would seem more feasible to leave the question of the pathogenesis open.

The mechanism of the appearance of chyle in the dilated lymph spaces is interesting. Despite the definite clinical findings in the cases reported, no satisfactory explanation has been offered of the lymph stasis. The predilection for the development of lymphangiectasis on the inner surface of the thigh and genitals is well supported anatomically, as Neumann pointed out. The lymph spaces in these regions are very abundant, have thin walls, and are superficial. Any increase in pressure would be more likely to be followed by external dilatation here than any part of the body. The presence of chyle in the dilated lymph spaces, however, presumes a retrograde stasis. Under such a condition only two explanations seem feasible—either a congenital, abnormal communication between a chyle vessel and one of the lymphatic vessels of the lower extremity or obstruction of the chyle flow into the thoracic duct by a luetic

or tuberculous gland. The latter possibility is illustrated by the diagram in Fig. 2. An area of obstruction is considered in the region of the celiac nodes. The diagram illustrates the normal course of lymph flow along the right iliac artery and the partial reversal along the left resulting from an area of obstruction in the celiac nodes. Because of this obstruction, chyle coming from the intestine is prevented from passing into the thoracic duct via its main intestinal trunk, and is forced to find an

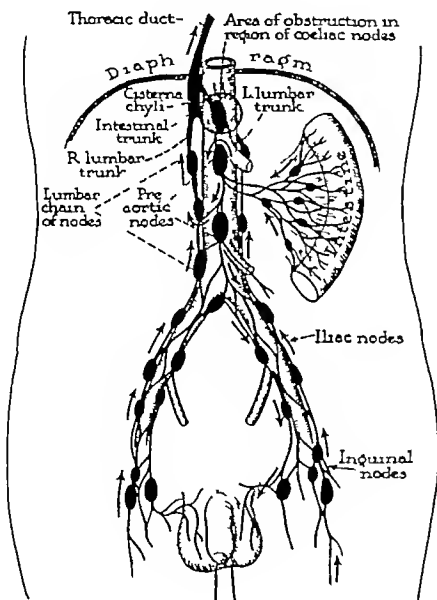


Fig. 2.—Diagram showing possible mechanism of lymphangiectasis with chyloorrhea in this case.

cessory anastomoses to reach that duct. During the period of increased flow following digestion these anastomoses are inadequate to carry the load. Much of the chyle backs up into the ileac lymphatics even to the extent of distending their superficial tributaries—the skin region of the femoral trigon and scrotum. The profusion of broad spaced lymphatic plexus with thin walls in these areas in which the skin as well as the superficial fascial layer, is thin permits such vessels to become easily distended by back pressure.

SUMMARY

A case of lymphangiectasis with chylorrhea is reported. The question of pathogenesis is discussed, and evidence is presented to explain its occurrence as a result of acquired disease

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THE DIAGNOSTIC TUBERCULIN REACTION

AN EVALUATION OF TOTAL PROTEIN TUBERCULIN (SEIBERT) AND DERMOTUBIN (LÖWENSTEIN)

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THE diagnostic importance of the tuberculin test is well recognized at the present time. There is much less general agreement, however, regarding the type of reaction which is best suited to general practice. Since Koch's original experiment a large number of techniques have been devised for applying the test. Many of these have been abandoned. The principal procedures in vogue at the present time are the cutaneous test usually employed by the scarification method of von Pirquet, the intradermal reaction of Mantoux, and the subcutaneous test or one of its modifications. Other tests such as the percutaneous reaction of Moro and the conjunctival reaction of Calmette and Wolff-Eisner, are used to some extent in various sections of the world but are not at all extensively employed in America.

The purpose of this investigation was to evaluate several commonly employed methods of tuberculin testing with relation to each other. In this regard we were especially interested in two procedures which are comparatively new: first, the use of a purified protein tuberculin (TPT Seibert) and second the evaluation of a percutaneous reaction using a tuberculin ointment devised by Löwenstein designated as dermatubin. To test these materials simultaneous tuberculin reactions were given on all patients admitted to the Cook County Children's Hospital in the following manner. On the right forearm an intradermal reaction was given with 0.1 cc. of a 1:100,000 solution of TPT (Seibert) yielding 0.001 mg. of purified tuberculin protein to the dose. On the upper portion of the left forearm in a corresponding area an intradermal injection of 0.1 cc. of a 1:1,000 solution of Koch's old tuberculin (Meister-Luecus and Brüning-Hoechst A. M.) in normal salt solution, giving a dose of 0.1 mg. OT. On the lower portion of the left forearm a Pirquet test was given using the same OT undiluted, and on the thorax over the upper end of the sternum a dermatubin test was given using Löwenstein's ointment. In this manner interesting data were obtained relative to the incidence of the positive tuberculin reaction in this group of the population and also the comparative value of the different methods could be assessed.

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The TPT (Seibert) used in this investigation was supplied by Parke Davis and Co., Detroit, Michigan.

This report comprises the results of such routine testing in 647 consecutive admissions to the wards of the Cook County Children's Hospital. All types of cases were included, admissions to the general medical wards, the surgical ward, the orthopedic ward, and the children's venereal ward. The medical cases included a small group of children with clinical tuberculosis. The distribution according to age is given in Table I.

TABLE I
DISTRIBUTION OF TUBERCULIN REACTION ACCORDING TO AGE

AGE	NEGATIVE TO ALL TESTS		POSITIVE TO 1 OR MORE		TOTAL
	NUMBER	PER CENT	NUMBER	PER CENT	
6 mo. to 2 yr.	87	82.9	18	17.1	105
2 yr. to 5 yr.	125	78.2	35	21.8	160
5 yr. to 10 yr.	170	74.3	59	25.7	229
10 yr. to 15 yr.	80	52.3	73	47.7	153
Total	462	71.4	185	28.6	647

Comparatively few infants were included, most of the patients ranged in age from two to fifteen years. Most of the children were white although there was a fairly large representation of colored races (30 per cent), principally negroes. From the sociologic standpoint, these cases were drawn from the lowest strata of urban population. Most of them came from overcrowded sections of the city where opportunity for contact with open tuberculosis should be great. The geographic distribution reveals that most of these children were living in the congested districts of the west side in the immediate vicinity of the hospital and in the colored sections of the south side. An attempt was made to correlate the reactions with a definite contact history, but in common with previous experiences with similar groups of people, it was found that reliable histories were unobtainable in most cases.

METHOD

All four reactions were carried out simultaneously upon admission except in a few cases of known active tuberculosis or where obvious tuberculin hypersensitivity was present, e.g., phlyctenar disease of the eye. The intradermal and Pirquet reactions were carried out in the usual manner. The dermatuberculin test is less familiar in America. This is a modification of the Moro reaction and is carried out in a manner similar to that of all percutaneous tests. According to Lowenstein,¹ the ointment consists simply of a concentrated glycerin bouillon culture of tubercle bacilli in which no other ointment base is used except the glycerin contained in the media. It consists, therefore, of concentrated tuberculin and killed bacilli. The material is supplied in small, glass stoppered vials or 1 cc. collapsible tubes. The skin over the upper end of the sternum is thoroughly cleansed with ether or benzene, to remove the fat, a small drop of ointment is placed on the prepared skin and gently rubbed with the finger or with a small glass rod for about a minute. The skin is then left exposed to the air for ten minutes. The reaction is best read at the end of forty-eight hours though occasionally it reaches its height in seventy-two hours. A positive reaction consists in the appearance of typical pale red, pinhead

sized papules, from one to thirty or forty in number usually located on an erythematous base. One typical papule suffices for a diagnosis. Three degrees of positive reactions are described: (1) papules, (2) confluence of these papules into a patch of erythema from 3 to 5 cm. in diameter, and (3) vasculature. Some experience is necessary in recognizing typical papules but the reaction is very characteristic. Its great advantage lies in the ease and painlessness of application.

Total protein tuberculin (TPT, Seibert) consists in a highly purified principle isolated from tuberculin as a result of the comprehensive series of experiments conducted by Seibert and her associates. This material is practically pure protein and yields clear cut reactions in high dilution in tubercle infected individuals. The material was supplied for this experiment by the manufacturer in vials containing a compressed tablet of 0.01 mg. tuberculo-protein. A properly buffered diluent was supplied in a separate vial. When ready for testing 1 c.c. of the diluent was introduced into the vial containing the tablet of TPT, which was then dissolved. One tenth c.c. of the resulting solution was injected intradermally into the right forearm.



Fig. 1—Typical positive dermatotuberculin reaction. (7 hours.)

yielding a dosage of 0.001 mg. of tuberculin. The material was thus always used freshly diluted. Reactions were read at the end of forty-eight hours.

The criteria adopted for the diagnosis of a positive tuberculin reaction other than the dermatotuberculin, were: (1) the presence of definite induration and (2) a minimum diameter of 1 cm. Erythema without induration was considered a negative reaction. Only the strengths of tuberculin mentioned were used since after preliminary testing they were considered to be most desirable for routine use although it was recognized that a small proportion of infected individuals with low degrees of sensitivity would be missed. Since D. Arcy Hurt states that 0.1 mg. OT intra-dermally carries a diagnostic error of from only 4 to 6 per cent for all age groups it was felt that such a test would constitute an effective check in comparison with the new materials studied.

RESULTS

In a series of 647 consecutive children a positive reaction to one or more of the tests was obtained in 185, or 28.6 per cent (Chart 1). Of this number 111 reacted positively to all tests. In the case of indi-

vidual tests the highest percentage of positives was obtained with the intradermal reactions. Here the total protein tuberculin in the strengths used was found to produce a distinctly greater reaction than a 1:1,000 solution of old tuberculin. With TPT 178 (96.2 per cent) of the positive reactors gave clear-cut positive tests while with OT 166 (89.7 per cent) yielded positives. Thus with a dose 1 per cent as great, more positive reactors were detected with TPT than with OT.

The dermatubim test yielded 152, or 82.1 per cent, of all positive reactors. This result is distinctly less favorable than that obtained by either intradermal method. The percentage, however, is much better than that yielded by the old Moro ointment (Ektabin), which in most

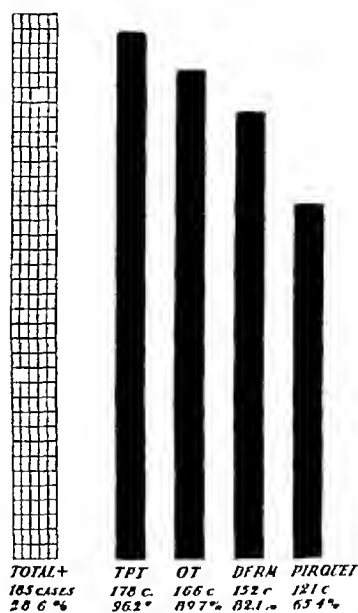


Chart 1—Graph showing the relative proportion of total positive reactions yielded by each test.

investigators' hands gave about 50 to 60 per cent of positives. In our series it was also distinctly superior to the cutaneous reaction of von Pirquet, which yielded only 121 (65.4 per cent) of the total positives. Lowenstein quoted a number of workers who have used dermatubim in large series of cases. He stated that all agreed it was diagnostically equal to the Pirquet. Goldberg and Gasul⁴ reported the results of 109 tests in which the dermatubim reaction was compared with the Moro, the Pirquet, and the Mantoux. Of these 39 per cent were positive to both the dermatubim and the Mantoux reactions, 36 per cent to the Pirquet, and 20 per cent to the Moro. These figures are not in agreement with our findings, the Mantoux with 0.1 mg. OT being definitely superior to the dermatubim test. Kaan⁵ found 94 per cent of tuberculous

individuals reacted positively to Löwenstein's ointment. Kundratitz⁷ states that the dermatubulin test, although a valuable diagnostic agent is not as reliable as the intradermal reaction. Mundt⁸ applied Löwenstein's ointment to sixty adults with tuberculosis and obtained a positive reaction in almost 100 per cent. McKim⁹ found the parentaneous test, Fkubm or dermatubulin, and the Pirquet test to be of equal value from a diagnostic standpoint.

There is considerable disagreement in the literature regarding the efficiency of the diagnostic Pirquet reaction. D. Aron Hart³ analyzed the results of forty-two authors who tested 4,787 cases of undoubted clinical tuberculosis. In this group the average error of the Pirquet test in the negative diagnosis of tuberculosis amounted to 16 per cent. When the cases were analyzed according to age it was found that the error increased to 23 per cent among children. Hart stated that the Pirquet test as ordinarily performed is totally unsuitable for the negative diagnosis of tuberculosis. Wallgren⁶ stated that the Pirquet test missed



Fig. —Moderately positive Mantoux with TPT 0.001 mg

20 per cent of the individuals infected with tuberculosis and that an intradermal test is absolutely indispensable to exclude scientifically tuberculous infection. Tisdall and Brown¹⁰ tested 177 patients with both intracutaneous and scarification methods. They found 15.3 per cent gave negative reactions to the Mantoux 0.25 mg. while 41.9 per cent reacted negatively to the Pirquet. These authors stated that the intracutaneous test was infinitely superior to the Pirquet as ordinarily performed. In our series the scarification method of Pirquet yielded the poorest results of all. This was not dependent upon inferior tuberculin since the same material was used undiluted for the Pirquet as was used for the intradermal, the former giving 65.4 per cent of all positives and the latter approximately 90 per cent.

DISTRIBUTION OF THE POSITIVE REACTION

The children in this group of cases represent a special class of the population. They were all sick children; they were drawn from the poorer classes; they came principally from a relatively small area of the city, and they included a large percentage of colored children. For these

reasons the data given here are not directly comparable with similar statistics relative to the incidence of the positive tuberculin reaction in various urban populations. They are of interest, however, as an example of the incidence of the positive reaction in a hospital group. There are no published statistics regarding the distribution of positive reactors in Chicago. In other cities surveys have been made from time to time. Hart reviewed the literature on this phase of the problem completely. The findings twenty years ago in large European cities showed that at five years of age one-half the children reacted positively to tuberculin, at ten years about three quarters, and at fifteen practically every child showed a positive reaction. Hetherington, McPhedran, Landis, and Opie¹¹ in a recent survey of school children in Philadelphia obtained figures only slightly below these. The averages obtained were 37.7 per cent at five years, and 90.2 per cent at eighteen years. In our group, although they represent a section of the population which should be most extensively tuberculized, the incidence of the positive reaction was far below these figures. In the group from two to five years of age 21.8 per cent reacted positively, five to ten years 25.7 per cent, and ten to fifteen years 47.7 per cent. Thus in the oldest group less than one-half showed positive reaction (Table I). When the races are separated, we find a very interesting difference in the incidence of the positive reaction. Two-thirds of these children were white and of these only 18.7 per cent yielded a positive reaction. On the contrary in the colored, practically all negro, 45.6 per cent of the entire group were positive (Table II). These figures indicate that of the children ad-

TABLE II
DISTRIBUTION OF THE TUBERCULIN REACTION ACCORDING TO RACE

RACE	NEGATIVE		POSITIVE		TOTAL	
	NUMBER	PER CENT	NUMBER	PER CENT	NUMBER	PER CENT
Colored	132	54.4	109	45.6	241	32.6
Negro	118	54.9	97	45.1	215	
Mexican	13	52.0	12	48.0	25	
Filipino	1		0		1	
White	330	81.3	76	18.7	406	67.4

mitted to the Cook County Hospital, the number who have been infected with tuberculosis is about one-half that of the old European and recent Philadelphia series. Furthermore, the white children as a group are not at all extensively infected. Most of the positive reactions are contributed by the colored children negro and Mexican, the incidence of infection being roughly two and one-half times as great as in the white. The geographic distribution confirms this finding and shows a very large number of positive reactors coming from the negro districts of the south side. Although we are dealing with a special section of the population, the figures are very striking, they indicate that while the spread of

tuberculous infection is apparently not great on our white population an important source of infection is still present in our colored districts

COMMENT

The selection of the most desirable technic in the performance of the diagnostic tuberculin reaction for routine office or hospital use is of great importance, particularly in pediatric practice. Several considerations must be met. First and most important, the test should be sufficiently sensitive to detect a high percentage of infected individuals. There are also secondary considerations, which are of importance to the practitioner. The test should be easy of application, should not require extensive preparation and should be as painless as possible. It is obvious that the primary consideration is best met by the intradermal test. It may be carried out with a high degree of accuracy in dosages, free from danger of undesirable local or general reactions. The test requires some special training in its application, requires preparation in making dilutions and sterilization of syringes and needles, and is undoubtedly painful. Sensitive children are often much upset by the extensive preparations, and the somewhat elaborate technic excites comment from the parents, usually necessitating lengthy explanations of just what the test signifies. Many individuals are badly frightened by the statement, 'a test for tuberculous infection,' and the stormy reaction of the parents to such explanation often precludes the routine use of a test which otherwise might well be employed as a part of each office examination. In hospital practice, however, these objects are usually unimportant. It is our belief that the intradermal reaction using 0.001 mg TPT or 0.1 mg OT should be used as a routine in all children's hospitals to the exclusion of any other method. In this way a very high percentage of all positive reactors will be detected on admission, and in the few negative reactors where the diagnosis is still in doubt subsequent intradermal tests with stronger solutions of either of these materials may be employed. In the strengths used, vesicular reactions were occasionally obtained in hypersensitive individuals but bad sloughs or focal or general reactions were not seen.

The dormotubin test while it does not fulfill the requirement of accuracy to the extent of the intradermal, is still a fairly sensitive test. Its great value lies in the ease and painlessness of application which makes it most desirable for routine office use. A drop of ointment may be rubbed into the skin very casually without exciting any comment from either the mother or child. The test is so simple that it may also be used in the routine preparation of children by nurses where tuberculin tests are desirable but the time of a medical attendant is not available at all times as in health centers of various sorts. Though there may be some objection to nurses carrying out such procedures there is so little possibility of injury that such a routine might be employed safely. By its widespread use many positive reactors might be detected even in re

mote communities, and thus sources of infection discovered. The only objection to the test is that the material, not manufactured in America, must be imported, with the result of increased cost.

The distribution of positive reactors in the Cook County Hospital children is of interest because of the general low incidence of positives and the very low percentage of white children infected. These figures, while not the result of a complete survey of well children, are encouraging since they seem to indicate progress in the control of the spread of tuberculous infection. The negro group, however, is still heavily infected, and the colored districts are a source of danger since much open tuberculosis must be present in these areas. The tuberculosis morbidity in Cook County Children's Hospital confirms the results of the tuberculin tests. A total of 3,099 children were admitted to the medical wards in 1932. In this number were 110 cases of clinical tuberculosis. Of these sixty-four, or 58.1 per cent, died, nine were discharged unimproved, twenty-six were discharged improved, and eleven remained in the hospital chronically ill. About 80 per cent of these cases were colored children.

CONCLUSIONS

1 The intradermal reaction is best suited for routine hospital use and should supplant other methods for this purpose.

2 Total protein tuberculin (TPT Seibert) is extremely sensitive and will detect a higher percentage of positive reactors than old tuberculin in doses one hundred times as great.

3 The dermatubim test, less sensitive than the intradermal test, is extremely useful because of the ease and painlessness of its application. It is well suited to routine office use.

4 The Pirquet scarification reaction is greatly inferior to either the intradermal or dermatubim test. Either of the latter are therefore preferable for routine use.

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BRUCELLA INFECTION IN CHILDREN

AGGLUTINATION REACTIONS AND INTRACUTANEOUS TESTS

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DESPITE the fact that *Brucella* infection (undulant or Malta fever), in adults has been increasing in the United States during the past ten years comparatively few cases have been found in children. The usual method of infection in children is by drinking raw milk containing *Brucella* organisms and considering the widespread distribution of *Brucella abortus* infection among the cattle of the United States, it is remarkable that so few cases occur. This situation is in part explained by the low pathogenicity of the average organism, pasteurization of milk, and the difficulty with which the human can be infected with this organism by way of the alimentary tract. It is possible that children may become immune as a result of ingesting the organisms in raw milk without having clinical infection.

Evidence of apparent immunity is suggested by the results of a study of a group of children inmates of an orphanage who until October 1931 were drinking milk infected with *Brucella* organisms of relatively low virulence. Attention was called to this situation by the occurrence of two typical cases of the disease in the institution, in a boy nine and in a girl four years old.¹ The organism was isolated from the blood of both patients on several occasions and through the courtesy of Dr. Theobald Smith was identified as a porcine strain of low virulence. Contagious abortion had been present for the past ten years in the herd supplying milk to the orphanage. Twelve of eighty-seven cows were found to have agglutinins in their blood serums, and these were removed by October 15, 1931. Serums from fifteen of a herd of seventy-five hogs were tested with negative results. None of the children in the orphanage had contact with the animals or with raw meat products but all were drinking at least a pint of raw milk daily. Agglutination reactions and intracutaneous tests were made on 210 children in the orphanage between four and fifteen years of age who had been drinking infected milk for at least five months—some for as long as six years. They were closely supervised and were hospitalized for the slightest illness or if the mouth temperature was above 37.3° C. None of them had, at any time while in the orphanage illnesses resembling *Brucella* infection.

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Agglutination Reactions The agglutination tests were made with four antigens of turbidity corresponding to the 1 4,000 U S Public Health Silica Standard O, the organism isolated from the blood of the two patients with the disease, P, a virulent porcine organism, B, a bovine organism strain No 456 of the U S Hygienic Laboratory, and C, a caprine organism, strain No 428 of the Hygienic Laboratory. The serums were in dilutions of 1 20 to 1 640. The tubes were placed in a water-bath for one hour at 37° C, left in the ice box overnight, and read at the end of twenty-four hours, in a uniform light. When the results were indefinite or the controls positive, the tests were repeated. Table I is a record of the agglutination tests done on forty-eight children tested three weeks after they had stopped drinking infected milk, seven were positive, although none of them had ever had symptoms of Brucella infection. When tested two months later, these seven children had lost their agglutinins. A second group of 164 children in the institution was tested between November 24, 1931, and January 8, 1932, six to twelve weeks after they had ceased drinking infected milk, and none of them showed agglutinins.

Intracutaneous tests were done with a heat-killed saline bacterial suspension of the O strain, isolated from the active cases in the institution, and standardized by comparison of turbidity with the 1 1,000 U S Public Health Silica Standard. As a 1 15 dilution of this standard caused a marked reaction in the skin of the two patients who had recovered from the disease, 0 1 cc of this dilution was used for the tests. A definite erythema, 1 cm in diameter, persisting for at least forty-eight hours was considered a positive test. Those children who had positive tests had larger reactions when a 1 5 dilution was used.

Table II shows the results of the intracutaneous tests done on 210 children. Twenty-seven, or 13 per cent, were definitely positive, six, or 3 per cent, had questionable reactions. The children who had positive reactions and an equal number who did not react were tested with strain No 456, and the reactions were identical with those obtained with the O strain. The thirty-three reactors were tested several times between June, 1932, and April, 1933, and on the latter date, twenty months after the infected milk was discontinued, twenty-six of them still reacted in the same degree, and seven had become negative. However, only two of these seven were definitely positive when first tested. The twenty-six controls were infants in another institution, who were from three to eighteen months of age, and who from birth had been fed evaporated milk. None of them had positive tests.

DISCUSSION

Apparently it is possible for children to develop agglutinins for Brucella organisms without having a clinical infection, as suggested by the fact that seven of the first forty-eight children examined (14 6 per

cent) had agglutinins in their blood. Larson and Sedgwick² found that 17 per cent of 425 institutional children who were ingesting *Brucella abortus* in milk had positive complement fixation tests, and that the agglutination test paralleled the complement fixation test. Dietrich and Bouvage³ found only one positive agglutination test among 1,000 children in the vicinity of Los Angeles; this child had been drinking raw milk on a farm in Kansas. Apparently, it is necessary to ingest fairly large numbers of organisms over a considerable period of time in order to form agglutinins without clinical evidence of the disease. Furthermore, the agglutinins tend to disappear rapidly when the infected milk is discontinued; for the seven children who had agglutinins had lost them within two months, and in the second group of 164 children under the same conditions, tested from six to twelve weeks later, no agglutinins were found. Agglutinins formed during a clinical infection, disappear rapidly during convalescence. Occasional cases of *Brucella* infection in which no agglutinins were present during the disease have been reported. We have seen two such cases in children.¹

TABLE I

AGGLUTINATION REACTIONS OF FORTY EIGHT CHILDREN THREE WEEKS AFTER THEY HAD CEASED DRINKING RAW MILK INFECTED WITH *BRUCELLA MELITENSIS*, VARIETY SUIB

CASE NO	AGE IN YEARS	DURATION CONTACT	ANTI GEN	AGGLUTINATION TITRE			INTRACUTANEOUS TESTS	
				11/5/31	11/24/31	1/8/32	6/21/32	3/23/33
10	5	- yr	O	1:80	0	0	++++	++++
			P	1:160	0	0		
12	6	4 yr	O	control	1:640	0	++	?
			I	pos.	1:160	0		
10	6	3 yr	O	1:320	0	0	++	++++
			P	1:80	0	0		
26	6	5 mo	O	1:160	0	0	+++	++++
			P	0	1:640	0		
27	6	18 mo	O	1:640	1:160	0	++	++++
			P	1:640	0	0		
			B	1:160	1:160	0		
			C	1:80	0	0		
28	6	2 yr	O	1:320	0	0	+++	?
			P	1:320	1:640	0		
48	15	6 yr	O	1:160	0	0	+++	+++
			P	1:640	0	0		
Remaining 41 of the 48	5-17	4 mo to 6 yr	O	0			7 chil dren	7 chil dren
			P	0				
			B	0			+++	+++
			C	0				

O, strain isolated from cases at Orphanage

P, virulent porcine strain

B, strain 456 U. S. Hygienic Laboratory

C, strain 428 U. S. Hygienic Laboratory

The intracutaneous test should be read at both forty-eight and seventy-two hours, as the time of maximal reaction varies with the individual child. Thus, some reactions that are markedly positive

TABLE II
INTRACUTANEOUS REACTIONS (BRUCELLA)

SOURCE OF MILK	POSITIVE	QUESTIONABLE	NEGATIVE
Infected herd	27	6	177
Evaporated milk	0	0	26

with edema and swelling at forty eight hours may show only a small papule at seventy-two hours. In this series in which 320 intracutaneous tests were done on 210 children, no reaction reached its maximum later than seventy-two hours after injection. In many of the children with marked reactions, a small papule remained and was present for several months. In no case, with the dilution used, did necrosis occur, although four children had slight fever (37.8°C) on the day following the injection. Leavell and Amoss,⁴ and other workers,^{5, 6, 7, 8} have found that a saline bacterial suspension gives more accurate results than filtrates or extracts of the *Brucella* organisms. Apparently any virulent *Brucella* organism can be used for the test. Care must be taken not to use too heavy a suspension, as a necrotic papule may form, lymphangitis (sterile) has been reported⁹ and general reactions often occur. A dilute suspension gives equally good results. The average ward patient is not a suitable control for the intracutaneous test, as he may have been in contact with *Brucella* organisms and therefore may react positively.

A positive intracutaneous test means active clinical infection, previous infection, or contact with the organism without clinical infection. On the other hand, despite statements to the contrary¹⁰ a negative test does not rule out active infection, for we have seen a child who had had the disease for eighteen months and yet intracutaneous tests with his own organism, and with strain No. 456 were negative.¹

CONCLUSIONS

In a group of 210 children drinking milk infected with *Brucella melitensis*, variety *suis*, of low virulence

- 1 Two developed the disease
- 2 Fourteen and six-tenths per cent of the 48 tested early had agglutinins without clinical evidence of the disease
- 3 The agglutinins disappeared rapidly when the infected milk was withdrawn
- 4 None of the 164 tested several weeks later had agglutinins
- 5 Thirteen per cent of the 210 had positive intracutaneous reactions
- 6 When strongly positive, this reaction persisted for at least four-months
- 7 A positive intracutaneous reaction indicates the ingestion of some

variety of *Brucella melitensis* at previous date, but not necessarily a clinical infection

8 A negative intracutaneous test as well as a negative agglutination test does not eliminate the possibility of a clinical infection

9 Normal infants who have not received infected milk do not have positive intracutaneous tests

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Duke Hospital

Pediatric Clinics

THE BABIES HOSPITAL AND DEPARTMENT OF DISEASES OF CHILDREN, COLUMBIA UNIVERSITY, NEW YORK

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NEW YORK, N. Y.

A DESCRIPTION of the pediatric clinic of Columbia University College of Physicians and Surgeons must be prefaced by two definitions. First, in the university organization the department is known as the Department of Diseases of Children, but the scope of the department extends to cover health as well as disease in children, as implied in the word "pediatrics." Second, the center of clinical facilities for the department is the Babies Hospital of the city of New York; the upper age limit of thirteen years signifies, however, that children as well as infants are admitted.

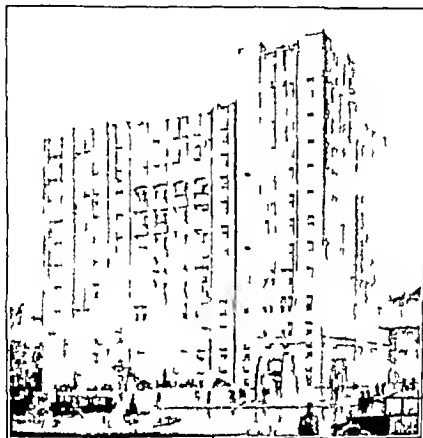
The departmental staff includes eleven full time members, not including hospital internes and residents, and about fifty part time physicians. All of the full time staff are engaged in investigative work, some of it in clinical fields, others in the laboratories or in combined clinical and laboratory studies. A portion of the part time staff has supervision of a ward from time to time, alternating with out patient work; others confine their work to the out patient department. The staff, as so described, includes the pediatric staff of St. Luke's Hospital and St. Mary's Hospital for Children, where elective courses for undergraduate students are given.

The research projects now actively under way include studies of the mechanism of formation and relief of edema; cholesterol metabolism and various clinical disturbances associated with its abnormalities; calcium and phosphorus metabolism in connection with certain bone diseases and disturbances of growth; the utilization of galactose in young individuals; factors influencing the osmotic pressure of the blood; the relationship of the hemolytic streptococcus to nephritis; the bacterial flora of the intestinal tract in early life with particular reference to the significance of bifidus organisms; and the classification and treatment of various forms of anemia. Under the supervision of the department of neurology, an investigation is being made of differential behavior patterns in normal children under the influence of a controlled environment, with special emphasis on the psychic and neuromuscular development of twins.

The Babies Hospital, which constitutes the pediatric division of the Presbyterian Hospital, has an active bed capacity of 152 beds, including fifteen private rooms and a semiprivate ward of twelve beds. These are divided among six floors as follows:

Infants, medical, up to 18 months,
Run about medical, 18 months to 5 years,
Children's medical, 5 to 13 years,
Surgical
Ear, nose, and throat,
Private floor

The hospital has its own surgical operating rooms, its pathologic laboratory for postmortem examination and surgical diagnosis its bacteriologic and chemical laboratories, and, of course the usual clinical laboratory facilities. It also has its own x ray unit. Equipped for the admission of all types of disease in children, it is operated in actual practice with a fairly rapid turnover patients with chronic illnesses requiring long hospital care such as tuberculosis of bone, being sent out to other institutions so that the facilities of the Babies Hospital are directed mainly at diagnosis and the treatment of acute conditions. Facilities are not ordinarily available for the treatment of the communicable diseases, such as measles diphtheria and scarlet fever, for which the Department of Health requires strict isolation although during times of a widespread epidemic like that of poliomyelitis in 1931 an entire ward floor has been turned over to patients with the one disease. It is also feasible to retain a patient with a communicable disease by providing special nursing

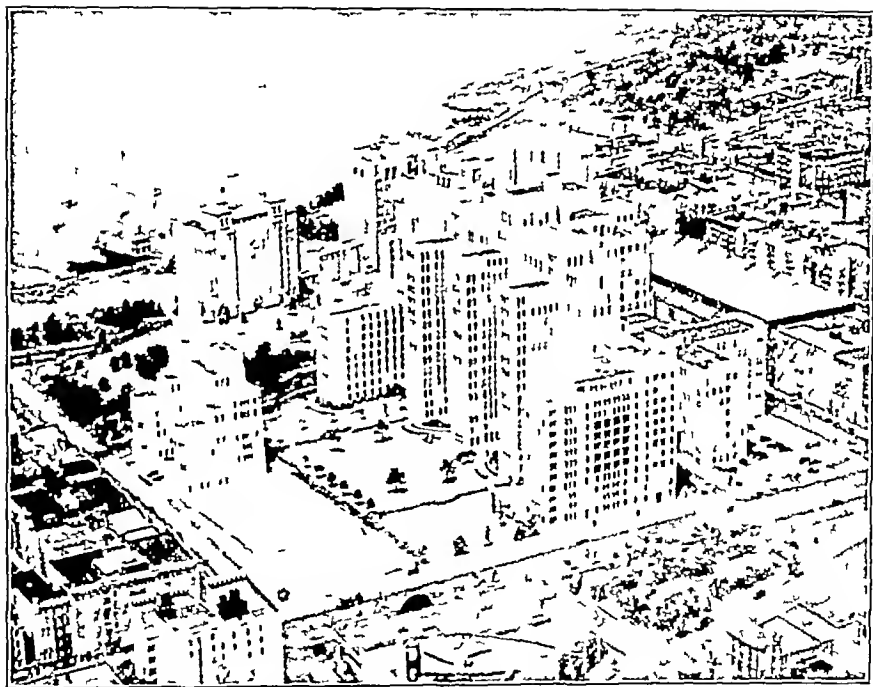


The Babies Hospital
Columbia Presbyterian Hospital Medical Center New York City

care this however, is seldom resorted to because of the excessive cost of nursing service required. The average number of hospital admissions per year during the last four years has been about 2,150, involving approximately 35,000 hospital days' treatment per annum.

The out patient department of the hospital is the pediatric section of the Vanderbilt Clinic, a separate building connected with the Babies Hospital by a covered bridge at the clinic floor level. The pediatric out patient clinic is staffed by a full time director and a working staff of internes from the Babies Hospital practitioners volunteering for clinic service and, during the school year to some extent by fourth year students under faculty supervision. About 7,800 new patients are seen each year the total visits per annum amounting to approximately 36,000. These figures apply to the general clinic, which is held every afternoon except Saturday Sunday, and holidays. Special clinics operated mainly in the mornings, are devoted to the following studies:

Allergy,
Anemia,
Cardiac disease,
Celiac disease,
Child guidance,
Congenital abnormalities and birth injuries,
Diabetes,
Epilepsy,
Medical follow up,
Neurologic follow up,
Nephritis,
Premature follow up,
Surgical follow up, and
Tuberculosis



Columbia-Presbyterian Hospital Medical Center
Babies Hospital in Right Foreground

The Babies Hospital visiting staff also supervises the nurseries for newborn infants and the premature service of the Sloane Hospital for Women, the obstetrical component of the Columbia Presbyterian Hospital Medical Center

The interne staff of the Babies Hospital consists of a resident and one assistant resident, each on service for one year, and nine internes on service for eighteen months. The interne services commence on the first of January and the first of July, and each interne has two months on each of the clinic floors listed above and, in addition, on pathologic laboratory service, Sloane newborn service, and on admitting duty, comprising in all, nine different types of pediatric experience. Both the resident and the assistant resident receive a small salary in addition to board, lodging and laundry, the internes receive no separate salary.

Staff conferences are held once a week during the school year at which problems of clinical and of scientific interest to pediatricians are set forth and discussed, and at which visiting physicians and medical students are welcome. Other scheduled exercises include a monthly clinicopathologic conference, semimonthly x-ray conferences, and the monthly meeting of the journal club, and each week at history meeting the clinical records of the most interesting or significant cases discharged within the past week are reviewed by the interns and resident staff, the physician in-chief and a group of attending physicians.

The School of Nursing provides a three-month course in pediatric nursing to forty-eight undergraduate students from seven affliating hospitals, a six-month course to four postgraduate students and a one-year course for fifteen infant nurses. Each ward floor is in direct charge of a graduate nurse and one or two graduate assistants; in addition, the private floor nursing staff comprises graduate nurses exclusively.

The undergraduate course in diseases of children at the College of Physicians and Surgeons comprises, in the third year, 20 lecture hours, 20 discussion hours and 12 hospital hours (the last mentioned in communicable diseases only); in the fourth year, 16 lecture hours, 30 clinical demonstrations and 18½ days of practical ward and out-patient service—a total of 203 hours. The 12 hours assigned to the study of communicable diseases take the student to the Willard Parker Hospital; the rest of the required time is spent at the Babies Hospital or in the out-patient clinic. Additional elective courses during the third year are given at St. Luke's Hospital under the supervision of Dr. F. Elmer Johnson and at St. Mary's Hospital for Children under Dr. Derer S. Byard.

Graduate physicians applying for a short course in pediatrics are customarily referred to the service of Dr. Roger H. Denuott at the Postgraduate Hospital and Medical School. Physicians approaching the study of pediatrics with the intention of equipping themselves as specialists in this field may offer themselves as candidates for the degree of D. Med. Sc., for which an intensive course is planned comprising three years' work at the Babies Hospital and allied institutions of the Medical Center.

The facility with which the resources of the other departments of the center may be utilized is an important factor both in the study of our more obscure pediatric problems and in our efforts in the field of pure research. It might be stated in summary that the Columbia Babies Hospital unit aims at a balanced grasp of its threefold opportunity in teaching in clinical service to the community and in investigation.

630 WEST ONE HUNDRED SIXTY EIGHTH STREET

Critical Review

ALLERGIC DISEASES

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WITH this year's review of allergic diseases, a certain amount of overlapping was unavoidable. The reviewer has tried, however, to eliminate repetition by referring to his previous discussion¹ where special phases of the subject were given more extensive treatment.

Progress was made along all lines, but 1933 did not keep up with the preceding four years in the publication of noteworthy books on allergy. *Allergy and Immunity in Ophthalmology*,² a monograph by Woods was the most outstanding piece of work. The book gave a very good statement of the present knowledge of allergy in its many phases and directed particular attention to the peculiarities of structure and reaction of the eye. *Some Thoughts on Asthma*³ by Cameron and Coke's *Colds and Hay Fever*,⁴ British publications, were not available.

Feinberg's⁵ manual dealing with *Asthma, Hay Fever and Related Disorders* may well be compared with Joslin's *Manual for Diabetic Patients*. Although large clinics may have certain written forms of instruction for patients, this book fills a definite need in eliciting cooperation from intelligent patients, and covers the field concisely and authoritatively. It might have been made more useful if a few recipes for egg free, wheat-free and milk-free foods were included.

GENERAL CONSIDERATIONS AND CONSTITUTIONAL STUDIES

Rackemann⁶ and his coworkers have continued to study the allergic constitution, and have found that agglutinin development (to typhoid) in a group of allergic individuals was lower than that found in a control group. The difference between the two groups was, however, not great. In contrast with McConnell,⁷ they found that the response of the skin in the allergic group was greater when tested with histamin than was the response in the control group.

Nelson,⁸ studying the allergic constitution, reported the predominance of this state in males in the first decade and in females in the second and third decades.

A short discussion of the asthmatic state and the rôle of varied stimuli made the paper by Baldwin⁹ very interesting. The symptom complex of asthma may have various causes, but the allergic is foremost, as is shown in the study of any group of asthmatic patients, and fortification of stimuli may then be a frequent occurrence.

Topper and Mulier¹⁰ in a study of the basal metabolism of twenty-five cases of asthma and twenty-five cases of epilepsy, found the rates for these conditions in the lower limits of the normal rates. Their interpre-

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tation of reduced thyroid secretion by exhausting episodes seems unwarranted in view of the known variabilities of the method and the slight differences they obtained

Accepting migraine as a symptom complex, Rinkel,¹¹ in a comprehensive and convincing discussion cast considerable doubt on the assumption that it is easily accounted for on an allergic basis. The reviewer feels that such reports are of the greatest value in checking the overenthusiastic statements of the past

Adamson and Sellers¹² in a less conservative discussion based, however, on a statistical study of the history and skin test, found a brief for the rôle of hypersensitivity in epilepsy

It would seem that adequate control statistics are difficult to evaluate. Vaughan's¹³ report on minor allergy suggested that while 10 per cent of the general population may have major allergic manifestations, fully 50 per cent may have minor episodic symptoms, which incidence speaks for a quantitative rather than a qualitative difference between the allergic and the normal individual, that the allergic response is only "an exaggeration of the physiologic response"

Rich,¹⁴ in discussing the allergic response in bacterial allergy took issue with the accepted theory that allergy is a phase or step in immunity and emphasized the harmful aspects of allergy which, he believed, should be avoided as they are not beneficial but, in all likelihood injurious

Among the British reports is a discussion by Burn,¹⁵ who suggested that asthma may be related to a deficiency of adrenal secretion. The idea is attractive from a theoretical viewpoint. Waldbott,^{16, 17, 18} in this country, made similar implications in his discussion of the relationship of status lymphaticus to allergy when he suggested that an anaphylactic edema of the lungs might be the cause of sudden death in such instances. Hypoplasia of the adrenals was a frequent pathologic finding. So far as thymic enlargement is concerned, the reviewer feels that Boyd's¹⁹ work has cast considerable doubt on its significance. The possibility of functional hypoadrenalism in allergy, however, might well be studied. Isolated instances with which the reviewer is familiar suggest that the benefit from insulin therapy may be interpreted as possible adrenal stimulation. The study of chloride, sodium, and potassium partition such as Loeb's²⁰ applied to Addison's disease has not to the reviewer's knowledge been applied to allergy.

Fineman²¹ has reported the use of suprarenal cortex extract in the treatment of bronchial asthma but he followed only the blood pressure, weight, pulse, etc. His results, while not striking, warrant further studies. It is the opinion of the reviewer that whole endocrine therapy has been disappointing in the past; the newer methods of hormone isolation may yet reveal some fractions other than epinephrin which will prove of value.

In several reports American investigators^{22, 23} have failed to substantiate the findings of Oriel and Barber²⁴ regarding the specific urinary protease. Westcott and Spain²⁵ have studied the sedimentation rate of erythrocytes in allergy. They found the rate within normal limits in pure allergic conditions, but more rapid than normal in conditions complicated by infection. Similar conclusions were made by Uffe.²⁶

DIAGNOSIS AND TECHNIC

Alexander²⁷ has made a brief survey of the methods used by various specialists in allergy in the United States and Canada. One is struck by the diversity of methods though there seems to be developing an agreement as to preferred routines. The efforts of the Society for the Study of Asthma and Allied Conditions to obtain standard terms and methods, etc., are interesting. Berkoff²⁸ described a standard for measuring skin reactions. The method may be of value in the study of small groups of cases, but it is impractical for wholesale adoption. Rowe²⁹ has reiterated the fallibility of the skin tests, especially to foods, and explained the value of his elimination diets. In contrast, Stewart³⁰ believed that, even granting the variability in technic and interpretation, the skin test remains of great value when intimate studies of the patient and the history are made. In these instances, the elimination diets are of secondary importance. Alles, Piness, and Miller³¹ reported the stability of some food allergen extracts for as long as seven years. Preservation was by storage in a cold atmosphere.

Rappaport³² has shown that ragweed pollen extracts may be preserved by concentration of the extract by drying at 40° C. From such concentrates dilutions may be made whose potency seems proportional to their nitrogen content. Extracts of pollen using 50 per cent glycerin are reported by Brown³³ as giving better results in treatment than those obtained with weaker glycerin or aqueous solutions.

An interesting discussion in the Society Transactions,³⁴ which gives more detail, concerns the method of standardization of pollen extracts as advocated by Cooke and his coworkers (Cooke, Vander Veer and Barnard,³⁵ and Cooke and Stull³⁶). Coca³⁷ contends that the method of determining total nitrogen content is not open to the criticism that obtains for the method of phosphotungstic (albumin nitrogen) precipitation.

It will be recalled that opinion is divided regarding the effect of treatment on the intensity of the skin test. Markow and Spain³⁸ reported a lessening of the cutaneous reaction after long therapy. Colmes and Rackemann³⁹ likewise found a decreased skin-test reaction in the majority of cases regardless of the number of therapeutic injections. They did not feel that this was parallel with the clinical response or that it might be used as a gauge of therapy.

Cromwell and Moore,⁴⁰ reported further immunologic relationships in extracts of short and giant ragweed pollen. By use of the trypan blue skin test for rabbits they concluded that the antigenic structures of these closely related pollens are different. With Unger,⁴¹ these investigators repeated Black's work on the polysaccharid fraction and the purified protein fraction of Stull, Cooke, and Chobot. They concluded from their animal and human studies that the protein fraction was essential while the polysaccharid played no specific part. The work of Vallery-Radot and his coworkers⁴² may well be mentioned here. His tests with root, stamen, and pollen extracts showed some relationship but still emphasized the specificity of the pollen fraction. Hence it would seem that allergens as exemplified by pollens showed extreme specificity even though related botanically and even though possessing some fractions in common.

Concerning passive transfer studies, the work of Lichtenstein⁴³ is inter-

esting. He was able by drying to preserve sensitizing serum for from six to fourteen months. While there was some diminution of skin sensitizing power, the redissolved serum was still potent. A toxic factor, as judged by the skin response on injecting the serum after six months' preservation, was noted. This may be due to a change comparable with that which occurs in undried serums after twelve days' refrigeration. Walzer⁴⁴ described a nonspecific cutaneous sensitivity which is passively transferable to normal skins. While Walzer stressed it as an indication for the necessity of control of Prausnitz Küstner reactions, the phenomenon suggests to the reviewer that it may also be considered an evidence of the transfer of hypersensitivity to trauma.

BACTERIAL ALLERGY

Reports in the field of bacterial allergy, although numerous, lead the reader to question the efficacy of the ordinary methods of allergy study such as the skin test, etc. Canfield⁴⁵ has reviewed some of the recent advances in bacteriology which might be expected to contribute to this clinical problem. Along this line, Benson⁴⁶ reported a study of skin tests made with extracts of gram positive cocci from normal and abnormal intestinal flora. He used extracts from both "R" and "S" types, finding little difference with regard to the skin response. "O" types gave a stronger reaction than "H". The finding of positive skin responses in nearly all patients (and controls) and the fact that reinoculated extracts were inert suggest a toxic response not altogether specific. It is possible that dilution of the bacterial allergen may diminish the general response leaving a more clearly cut picture of specificity. It is appropriate to mention the discussion of Benson's paper which appeared in the Society Proceedings,⁴⁷ where Cohen aptly called attention to the fact that the diagnosis of bacterial allergy, because of failure of common skin tests, etc., is open to considerable criticism and also to the fact that bacterial allergy is still difficult to compare with the usual forms. Thomas and Touart⁴⁸ described a late skin reaction to vaccine, which they considered a specific bacterial allergic response. They discussed its significance in relation to the selection of the vaccine for treatment, the dosage, and the time factor in administration. This delayed skin reaction resembles the so-called "patch" test used in dermatitis. The reviewer wonders if patch tests with bacterial products would be of any particular value. Delayed response is quite characteristic of the tuberculin and Dick tests, and an ointment tape test for tuberculosis has proved most reliable in Wolff's⁴⁹ study. Wilmer and Cobe⁵⁰ were enthusiastic about results from selective vaccines. They found that a selection of organisms, somewhat as pollens are selected for the hay fever patient, is preferable to the use of the nonspecific stock and autogenous vaccines.

It is not within the scope of this review to report the numerous studies in the field of bacteriology. It is sufficient to say that clinical studies may be ill advised unless competent bacteriologic supervision is obtained. After the confusion of reports regarding the many factors in the problem of bacterial allergy, the clinical discussion of Lintz⁵¹ is refreshing. He reported benefit in intractable asthma by sterile abscess formation. Such obvious nonspecific therapy (immune mechanism shock) followed by improvement makes one question the reports on specific bacterial fractions.

DERMATOSIS

Many dermatoses due to cosmetics are well known. During the past year considerable attention has been directed to eyelash cosmetics (Lash-lure, etc.). Widespread interest may have been excited by the recent publicity given by Mrs. Roosevelt to the dangers of these preparations. An excellent review of the rôle of cosmetics is that by Hollander.⁵²

Sulzberger and Keri⁵³ in discussing eczematous sensitization presented ten case studies in which the usual skin test was of no value while the patch test was very helpful. They found the patch test of exclusive value in occupational dermatoses, and they showed that the zones of clinical involvement were the most sensitive to the test. Sulzberger and his coworkers⁵⁴ also claimed that silk sensitivity is often found by test but that its significance, clinically, in dermatosis is open to question. Figley and Parkhurst⁵⁵ refuted this claim by reporting five instances of eczema, with silk sensitivity of major consideration, in which the patch test was negative and the skin test positive. The occurrence of respiratory symptoms also suggested to them that in many instances silk might act as an inhalant rather than a contact excitant. Taub and Zakon⁵⁶ likewise took issue with Sulzberger regarding the significance of silk reactions. Their cases had further study by passive transfer.

Greenhouse and Sulzberger⁵⁷ reported dermatitis from the common weed, tansy. As before, they reported negative skin tests but positive patch tests, and overdosage orally gave an acute skin response. A very interesting study of *Rhus toxicodendron* poisoning was that of Gowen.⁵⁸ It is strange, however, that no mention of the work in this field, which the reviewer feels is fundamental, was made by McNair.⁵⁹ Gowen reported excellent results both therapeutically and practically with the single intramuscular injection of the rhus extract in almond oil. No doubt this method will prove of great value in the treatment of similar (alcohol-soluble) plant fractions. Harville⁶⁰ found an alcohol-soluble fraction from the garden plant "bleeding heart" responsible for a dermatitis. Abramowitz and Noun⁶¹ described a dermatitis from chloral.

In the more general field of allergy, acacia has again been reported by Spielman and Baldwin.⁶² Watson and Kibler⁶³ attributed an instance of asthma to drinking water. Chlorination was held responsible by them for the action of the water, though salt used on the patient's food was innocuous. Discussion of this paper by Phillips⁶⁴ suggests that other factors may be involved. He referred to an instance of coal tar sensitivity in which oil used on the water pumps was the important vehicle. Harkavy,⁶⁵ interested in the rôle of tobacco in thromboangitis obliterans, found a preponderant number of positive skin tests in smokers with thromboangitis obliterans in contrast with smokers without this disease. The latter group, however, gave a greater incidence of skin reactions than the nonsmoking controls.

Kern and Schenck⁶⁶ showed allergy to be an almost predictable factor in the etiology of mucous nasal polyps. Their study was careful and convincing. Bullen⁶⁷ found the incidence of asthma in 400 cases of chronic sinusitis insufficient to incriminate the latter as a causal factor. His statistics for chronic bronchitis and bronchiectasis supported the same conclusion with regard to their etiology. It is the reviewer's opinion that in the past there has been an overemphasis on sinusitis as a cause of asthma. Sinusitis might occur secondarily as a result, not a cause, of edema of the nasal mucosa which prevents normal sinus com-

mucications, and many times the operative preparation (cocainizing of nasal mucosa) for sinus drainage may relieve a coincidental asthma. The latter phenomenon seemed a probable factor in the results obtained by Splavack.⁶⁶ His treatment of vasomotor rhinitis by painting the nasal wall with carbolic acid was followed by relief in ten out of sixteen patients. The treatment would seem not altogether free from hazard. Similarly, the treatment by Swineford and Wernberg⁶⁷ of a heat sensitive patient with vaccine appeared very courageous. It would seem that graded exposure to heat might well be tried before intravenous vaccine even admitting the beneficial results from that preparation in chorea.

Shookhoff and Lieberman⁷⁰ mentioned a new symptom referable to allergy in the occurrence of angina pectoris in patients with acetyl salicylic acid sensitivity, as well as in a patient with ragweed pollinosis. Preexisting cardiovascular disease seemed, however, to be a necessary factor. Purpura in a malarial patient is described by Cazot.⁷¹ While suggesting a type of allergic response to quinine, the report is not convincing.

In the study and treatment for inhalant excitants Feinberg and Steinberg⁷² found a variation in pollen potency with the season of collection. They also pointed out a lack of correlation between the pollen measure for ophthalmic and nasal tests when compared with the probable exposure measure for clinical response. Phillips⁷³ reported the satisfactory use of coseasonal intradermal pollen administration. Rappaport and Reed⁷⁴ found viosterol of therapeutic value in hay fever, but not in infectious asthma. Vaughan and Cooley⁷⁵ and Kahn and Grothaus⁷⁶ found the air-conditioned room of great value in inhalant sensitivity. The latter authors stressed the benefit in patients with negative skin tests. Lamson and Watry⁷⁷ have been making a detailed study of the botany and pollen factors along the Santa Fé Railroad in New Mexico and Arizona. Their reports although complete offer little except an explanation of a method which could be used in more populous districts. The Wodehouse⁷⁸ survey of Yonkers should prove of value because it is an analysis in a heavily populated district.

A new milk, wheat, and egg free food for infants with eczema has been studied by Cohen and his associates.⁷⁹ It is suggestive of the liver soup mixture used by Park many years ago in New Haven. From a theoretical aspect it would seem preferable to Sobee since this new preparation Cemac (Mead Johnson and Company) has its source of protein from beef. It is usually assumed that animal protein is a better tissue builder than protein of vegetable origin, experience to the contrary notwithstanding. Cohen's report of alleviation in the majority of patients fed with the preparation seemed a bit optimistic considering the multiplicity of factors which produce eczema. Nevertheless Cemac should be a welcome addition to our armamentarium.

Peck and Salomon⁸⁰ presented an excellent discussion of eczema. They minimized the rôle of foods and emphasized contact excitants (such as feathers) and the patch test.⁸¹ In the reviewer's hands the patch test in infants was unsatisfactory because of the heightened irritability of the infantile skin. Concerning the rôle of egg, which Peck and Salomon considered indicative only of the expected allergic constitution, the effect of feeding that food and its response to the patch test leave no doubt as to its specific importance.

In spite of progress obtained in recent years, allergy still presents many problems open to debate and offers an attractive experimental field for the investigator

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American Academy of Pediatrics

Proceedings

REPORT OF THE COMMITTEE ON HOSPITALS AND DISPENSARIES

INTRODUCTION

Many phases of work of the recent White House Conference on Child Health and Protection have been taken up and quite energetically followed by medical and lay groups. The problem of the child in the hospital has received comparatively slight consideration. Appropriately the American Academy of Pediatrics has made a study of this subject. In order to make a satisfactory study of the problem, the Committee decided that it was necessary to have detailed information concerning the various children's hospitals in this country and Canada. Consequently, there was obtained from the American Medical Association, a complete list of the children's hospitals in these countries. Here we met our first difficulty. No one knew what could be strictly classified as a children's hospital. Several hospitals designated as children's hospitals were really tuberculosis sanatoriums or convalescent homes for children. Many of the so called women's and children's hospitals were actually maternity hospitals in which the welfare of the child might be secondary in importance to the care of the mother. Several hospitals were excluded, which in themselves were children's hospitals, but were a part of a general hospital. The Committee finally after appealing to the membership of the Academy for advice as to whether certain hospitals could be classed as children's hospitals or merely as homes and sanatoriums, chose rather arbitrarily the hospitals in the group which is here being presented. We are relatively certain that the thirty five hospitals in this group represent all the large, general children's hospitals in the United States and Canada and that they do not include orthopedic or hospitals for contagious diseases, convalescent homes for children, summer camps, or tuberculosis hospitals for children. An attempt, therefore, has been made, as far as possible, to limit this survey to a study of the general children's hospitals. The following is the list of hospitals finally agreed upon.

Children's Hospital, Los Angeles, Calif
Hospital for Children, San Francisco, Calif
Children's Hospital, Denver, Colo
Children's Hospital, Washington, D C
Bobs Roberts Memorial Hospital, Chicago, Ill
Children's Memorial Hospital, Chicago, Ill
Sarah Morris Hospital, Chicago, Ill
Cook County Hospital, Chicago, Ill
James Whitecomb Riley Hospital, Indianapolis, Ind
Children's Hospital, Iowa City, Iowa
Children's Hospital, Portland, Maine
Harriet Lane Hospital Baltimore, Md

Boston Floating Hospital Boston, Mass.
 Children's Hospital, Boston, Mass.
 Children's Hospital Detroit Mich.
 Children's University Hospital, Ann Arbor Mich.
 Children's Memorial Hospital Kansas City Mo.
 St. Louis Children's Hospital St. Louis, Mo.
 Children's Hospital, Buffalo, N. Y.
 Babies Hospital New York, N. Y.
 New York Foundling Hospital New York N. Y.
 New York Nursery and Children's Hospital New York N. Y.
 St. Mary's Hospital for Children New York N. Y.
 Seaside Hospital, Staten Island New York, N. Y.
 Children's Hospital Akron Ohio.
 Children's Hospital Cincinnati Ohio.
 Babies and Children's Hospital, Cleveland Ohio.
 Children's Hospital, Columbus, Ohio.
 Children's Hospital Philadelphia Pa.
 Children's Hospital, Pittsburgh, Pa.
 Children's Orthopedic Hospital Seattle, Wash.
 Milwaukee Children's Hospital Milwaukee Wis.
 Montreal Children's Memorial Hospital Montreal Quebec, Canada.
 Toronto Hospital for Sick Children Toronto Ontario Canada.
 Children's Hospital of Winnipeg Winnipeg Manitoba, Canada.

Fully aware that the questionnaire method of obtaining information is not always entirely satisfactory the Committee could think of no other way to approach the subject in a manner any way adequate. If one resorts to the impressions obtained by personal contact, he is often forced to accept opinion rather than facts. By dealing with the questionnaire method one obtains only facts. Often in dealing with institutions impressions are of more value than facts and occasionally traditions are more valuable than either of these. However the mere physical side of a hospital is not the only thing which can be examined by the questionnaire method. By this method much can be discovered of the way in which the hospital is run and something of the ideals forming the background of its administration. The final form of the questionnaire was largely due to the cooperation and advice of Dr. Philip Van Ingen who had so much experience with questionnaires of all kinds during the late White House Conference. After the questionnaire had been prepared and the hospitals chosen each questionnaire was put in the hands of a member of the Academy associated with the particular hospital, with instructions that it was to be answered in detail. The task was carried out in every instance, and within four months all questionnaires had been answered and returned to the Committee. The Committee wishes to recognize this fine cooperation and to express its appreciation to these men.

After receiving and carefully tabulating the questionnaires the various sections were separated and placed in the hands of experts in the respective fields, with the request that they criticize them. As we anticipated much of the material which these experts wished was not obtained.

The Committee did not feel that it was fair to ask of individuals directly connected with the particular hospital their opinions as to the efficiency, or lack of it in that hospital. While many of these opinions might be eminently fair, there is always the possibility and even the probability, that no matter how strong the good intentions of the individual may be being human, he would have prejudices which would make it impossible to obtain an unbiased opinion. On the other hand, it is difficult for one coming from the outside to assess the place in the community which

the given institution holds, and therefore, the value of this opinion is impaired. We, therefore, concluded that the best we could do would be to gather facts and from these, so far as was possible, deduce some idea of the organization, efficiency, and personality of the particular hospital. The result has not been entirely satisfactory but much valuable information has been obtained as the present and subsequent articles will reveal.*

The Committee on Hospitals and Dispensaries of the American Academy of Pediatrics includes

Dr Clifford G. Grulec, Evanston, Ill., Chairman
 Dr George F. Munns, Winnetka, Ill., Secretary
 Dr Murray H. Bass, New York, N. Y.
 Dr L. R. DeBuys, New Orleans, La.
 Dr Roger H. Dennett, New York, N. Y.
 Dr Henry Dietrich, Los Angeles, Calif.
 Dr Lewis Webb Hill, Boston, Mass.

The Committee wishes to acknowledge the assistance given it by Dr Bert W. Caldwell, Executive Secretary, American Hospital Association, Dr Homer F. Sanger, Staff of the Council on Medical Education and Hospitals, American Medical Association, and Dr G. Harvey Agnew, Secretary, Department of Hospital Service, Canadian Medical Association.

A. PROFESSIONAL STAFF

1. *Attending Staff*

Since, as will be revealed later, nearly all the patients who go to children's hospitals are charity patients, it was not of so much importance to find out whether these hospitals had "open" or "closed" staffs. As a matter of fact, in twenty one of the hospitals all patients in the wards came under the exclusive care of the attending staff. In two hospitals any accredited physician in good standing could send patients into the wards and treat them there. In twelve hospitals a limited number of physicians outside the attending staff could send patients to the wards, and in one instance, this privilege was extended only to outstanding specialists. In other hospitals this courtesy was extended to members of the associate staff or former staff members. In six hospitals the courtesy was extended only for pay patients. Table I will give some idea concerning the attending staffs in these hospitals.

It will be seen that in most instances the hospitals had provision for attending men in nearly every specialty which was needed although comparatively few hospitals have staffs in psychiatry and psychology. In most instances, provision was made for these services by other than attending men. Oral hygiene was frequently associated with dentistry, as was oral surgery. Since urology of children has taken such rapid strides within the last few years, it is surprising to know that only fourteen of the thirty five hospitals have urologists. There were only nine of the hospitals that had any members on a full time basis, and these apparently were only in the pediatric staff. Where it was possible to determine, it was interesting to see what a large proportion of the hospitals have attending men for the full twelve months of the year and how few have even comparatively unimportant branches on call only. The Committee feels that from one to three months is too short a time to serve efficiently on any service and that six months should be the minimum period of service. Something may be said for an attendance which takes in six months of the year, but very little for any attendance of less than that time. This survey of the hospital staffs does not, of course, bring out the regularity of

*Since the data for these reports were obtained one hospital has been closed and become part of a general hospital. The original figures however have been included in this report.

TABLE I
HOSPITAL ATTENDING STAFFS

Hospitals hav- ing Total number of members With full time staff (1 or more) Length of service in months No. for 12 mo. "On Call only	PEDIATRIC STAFF	OTO-LARYNGOLOGY STAFF	ORTHOPEDICS STAFF	OPHTHALMOLOGY STAFF	URGENT STAFF	NEUROLOGY STAFF	PSYCHIATRY STAFF	PSYCHOLOGY STAFF†	DERMATOLOGY STAFF	DENTISTRY STAFF	GENERAL MEDICINE STAFF	GENERAL SURGERY STAFF	X-RAY STAFF	PATHOLOGY STAFF	ALLERGY STAFF	UROLOGY STAFF	CARDIOLOGY STAFF	DIABETES STAFF	GYNECOLOGY STAFF
35	35	35	35	34	35	35	27	10	35	33	30	25	34	35	21	8	2	1	1
493	210	110	-	-	20	16	-	-	17	110	13	-	15	14	-	1	1	3	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31 ^a	112	412	3-12	12	12	-12	-	-	412	412	-	-	412	4-12	-	-	-	-	-
14	14	-0	18	-	13	-	-	-	17	31	-	-	32	33	-	-	-	-	-
0	0	6	8	-	7	7	5	7	7	6	3	-	4	4	12	6	1	1	1

One hospital has facilities at Child Guidance Clinic three combine Neurology and Psychiatry
Twelve other hospitals have arrangements for psychologic work.

attendance nor the relative merits of the individuals employed. It is, of course, necessary for children's hospitals to take care of a larger number of pediatricians, than would otherwise be the case if the children's departments in general hospitals were more adequate. For this reason service of less than six months in some instances is thought to be necessary in order that all men on the staff may have an opportunity to work in the wards. A hospital service of less than six months would certainly not be of any great value to any one and, least of all, to the hospital. On the whole we may say that the evidence which is presented here concerning the attending staffs indicates that not only are the pediatric staffs adequate in number, but that there is a marked tendency to encourage the work of the other specialties in children's hospitals and to consult with these specialists.

2 House Staff

a Residents

Only three of the thirty five hospitals have no resident staff. One had as many as six, one, five, four, four, one, three, three, two, and twenty-one, one, making a total of fifty seven. All hospitals which have residents pay them a salary, these salaries vary from twenty five dollars to one hundred and fifty dollars per month. Women are eligible in two of the hospitals, and one hospital accepts only women as residents.

The length of service is one year in twenty eight hospitals and varies from three months to two years in others. The qualifications for residents vary greatly. In sixteen hospitals one year of general internship and one year of pediatric internship are required while in five hospitals three or more years of general and pediatric internship are required. Six hospitals require only one year of general internship, and one hospital requires only "previous hospital experience." Two hospitals require one year of general internship plus some pediatric experience. In contradistinction to these, one hospital required three years of pediatric internship.

In only ten hospitals the resident does not have dispensary duties. The duties of a resident in the dispensary vary greatly in different hospitals and, in one only, is the resident in charge of the dispensary.

With respect to the resident, therefore, we see that there are provisions for fifty seven residencies in the thirty five pediatric hospitals of this country and Canada, that the salary varies from twenty five dollars to one hundred and fifty dollars per month, that women are eligible to a large extent, and that the length of service in the average hospital is one year.

In view of the fact that the resident usually has considerable responsibility in the average hospital plan of pediatric care, it is gratifying to note that twenty hospitals require two or more years of previous hospital experience before a physician may qualify for that position.

We seriously question whether one year of general internship properly prepares a man for a residency, we feel that the minimum requirement should be one year of general internship and one year of pediatric internship or assistant residency.

About one third of the hospitals report that the resident has no dispensary duties. Undoubtedly dispensary service is a very valuable factor in training a young man for future work in pediatrics, and the resident should always have some duties there. Furthermore, his familiarity with the dispensary work will enable him to coordinate more efficiently the hospital and dispensary work.

b Assistant Residents

Twenty four hospitals have assistant residents. The number varies from one to eight, the total being seventy two. In twenty of the twenty four hospitals, assistant residents receive a salary and this varies between ten and eighty dollars per month. Women are eligible for this position in twenty three of the hospitals.

and in one hospital they alone are accepted. The length of service varies from three months to one year, but in twenty of the twenty four hospitals, the service is for one year. Qualifications for assistant residents are not quite so varying as those for residents. In fourteen hospitals one year general internship is all that is required, while in nine, one year general and one year pediatric internship. One hospital requires a year of general internship with some pediatric training. In sixteen of these hospitals, the assistant resident has general duties in the dispensary and in one he has optional duty.

We see, therefore, regarding assistant residents that there are places for seventy two, which makes a grand total of one hundred and twenty nine for residents and assistant residents, that the salary for assistant residents varies from ten dollars to eighty dollars per month, that the qualifications are in general, a general internship or that plus a year's pediatric internship, and that assistant residents are employed in dispensaries less often than are residents.

c. Internes

Thirty of the children's hospitals have internes. The number varies from one to fifteen. Five have ten or more. Ten have five to ten. Fifteen have five or less. In all these hospitals employ one hundred and eighty four internes. Only eleven of the hospitals pay salaries to internes and these vary from less than twenty five dollars a month to forty dollars a month. In four hospitals are women ineligible and in only one are men ineligible. The length of the interne service varies from six weeks to one year, but in nineteen of the thirty hospitals the service is for one year and in three for six months. In twenty six of the hospitals, the service is rotating. The time on each varies from two to four months. The qualifications for internes vary. In ten hospitals only the M.D. degree is required, but in twelve a year's general internship is necessary. In four hospitals the internes rotate through the children's hospital from a general hospital service. In all but three of the hospitals, the internes have general duties in the dispensary.

We see, therefore, that in all there are employed one hundred and eighty four internes in thirty children's hospitals of this country and Canada. Presumably the other five hospitals have only residents. An interne service of less than six months can certainly be of no value and should be discarded. Happily the number of these is decidedly few. Of the one hundred and eighty four internships, sixty two or almost exactly one-third have a service of less than one year. Dispensary duty is carried out in almost every instance and we feel that this duty is a very valuable experience to all internes.

A general survey of the residents and internes will show that there are every year in the thirty five children's hospitals, three hundred and thirteen internes and residents of which two hundred and fifty-one have at least one year's training, the other sixty-two being internes with less than a year's service. Of course it is altogether likely that many of the residents and assistant residents come up from the ranks of internes but since the residents and assistant residents constitute only one hundred and twenty nine the reduplication is not much. In all probability, we may say that there are to be turned out each year in the neighborhood of two hundred men who have had at least a year's training as resident or interne in a children's hospital. This group alone would certainly be sufficient to replace all vacancies in the pediatric profession caused by death, illness, etc. and would leave a large number for influence on general practice or other specialties.

d. Educational Activities

Some idea of the value of a hospital may be obtained by inquiring into its educational activities. In hospitals used for teaching purposes it has been found that the clinical and scientific work is much improved and such a hospital is an

TABLE II

	UPPER RESPIRATORY INFECTIONS	PNEUMONIA	TYPHOID FEVER	EPIDEMIO CEREBROSPINAL MENINGITIS	ERYSIPPELAS	APPETIGO	SCABIES	PEDICULOSIS	SYPHILIS	GONORRHEAL VAGINITIS	GENERAL OPHTHALMIO	ORTHOPEDIC	OTO-LARYNGOLOGIC	NEUROLOGIC
General Wards	7	5	1	0	0	1	4	7	18	0	0	18	23	29
Infectious Precautions	5	3	0	1	1	5	1	11	2	0	0			1
Cubicles	22	25		5	9	6	8	6	11	2	3			
Isolation			19	16	21	17	9	5	11	13	18	16	10	3
Special Wards	0	1	2	3	3	3	3	3	1	5	3			
Not Admitted	0	0	7	9	3	2	2	2	1	14	9			
No Reply	1	1	1	1	1	1	1	1	2	1	1	1	1	1

In some instances it was impossible to tabulate one or more of the replies

added asset to the community. Why hospitals in general have not seen this possibility and taken advantage of it is hard to account for.

Of the thirty-five children's hospitals, twenty-two are definitely associated with medical schools, and four loosely affiliated. Consequently more than two-thirds of the children's hospitals in the country are used for teaching. Twenty-eight hospitals have clinics for medical students, twenty-seven have ward walks, and five have clinical scholarships.

For the practicing physician, nineteen hospitals offer clinics, and one other offers clinics by courtesy and special arrangement. These clinics vary greatly; the most frequent ones coming weekly (in six hospitals). Ward walks for practicing physicians are held in twenty-six of the hospitals. Postgraduate instruction is offered in nine, in three of which the number of students is not limited. The others vary from four to one hundred and fifty. The total number enrolled for 1932 for these postgraduate courses was in the neighborhood of two hundred and fifty. The courses varied between two two-day courses to a course covering one year.

The instruction of the internes is carefully attended to in most of these hospitals, in fact, clinical conferences are held in all but three hospitals. The number of these conferences varies very widely. In three hospitals there are daily conferences, in seven they are held once monthly, the most common interval seems to be once weekly which takes place in fifteen hospitals. We feel that clinical or pathologic conferences should be held at least once weekly in all hospitals. Pathologic conferences are held with internes in all the hospitals but seven and these usually as often as once a week. Nineteen of the hospitals hold conferences in various specialties. Internes have special instruction in x-ray in nineteen hospitals and in diagnosis and therapy in five. They receive special instruction in the pathologic laboratory in eight hospitals, in the bacteriologic laboratory in fourteen and in the serologic laboratory in eight. They receive instruction in physiotherapy in only two of the hospitals, but they do receive instruction in diet and nutrition in seventeen. All but two of the hospitals have a medical library. This varies in size from twenty-five to thirty-one thousand volumes. All but four afford research facilities for the staff.

The educational facilities for the medical profession offered by the children's hospitals are distinctly above the average of those offered by other hospitals either special or general. There seems to be a realization that children's hospitals should be used for teaching not only for the medical students, but to a large extent for postgraduates and for internes who are receiving their training in these hospitals. While conditions are not all that one could wish for, the relative position of the children's hospitals in the matter of medical education either to the student, in ternes, or practicing physician must be quite high.

e. Special Information

The routine custom of the staff in handling patients is quite varied. It is surprising that there is so much difference of opinion. That observation or isolation wards, which are certainly desirable, should not be found in all the hospitals is of course, possibly due to a lack of space but that throat cultures, vaginal smears, etc., are not routine measures must be a surprise to anyone familiar with the work among children. There is a general agreement that when the child enters the hospital that blood counts, urinalyses, and tuberculin tests should be made and a complete history and physical examination, of course, should be required in all hospitals.

The handling of special cases is best exemplified in Table II, which needs very little comment. The wide variation of opinion as to what should be done with certain cases, is shown best in Table II.

News and Notes

The American Board of Pediatrics, Inc, met in St Louis, Mo, January 13, and adopted by laws and rules and regulations for certification. The following officers were elected: Borden S Veeder, President, Henry L Helmholtz, Vice-President, C Anderson Aldrich, 723 Elm Street, Winnetka, Ill, Secretary and Treasurer. The entire membership, which was announced in the December, 1933, issue of the Journal was present.

The following classification of groups for purposes of certification was decided upon.

GROUP 1

Physicians who have limited their practice to pediatrics for over ten (10) years. Until September, 1936, suitable applicants may be certified on record although examination is optional with the Board. After September, 1936, all candidates for this group will be required to take an examination.

GROUP 2

Physicians who have limited their practice to pediatrics for from six (6) to ten (10) years.

Applicants must submit evidence of at least one year's hospital training and one year's training in a recognized pediatric center and of continued work in some form of pediatric organization or institution. Examination is required.

GROUP 3

Graduates of five (5) years or less. Applicants must submit evidence of having finished one of the following forms of training:

- A One (1) year's service in a general hospital with two (2) years' service in a pediatric center, or three (3) years' service in a pediatric center.
- B Two (2) years' service in a pediatric center plus two (2) years' specialized practice in pediatrics, including continued work in some pediatric activity.
- C One (1) year's service in a general hospital, one (1) year's service in a pediatric center plus three (3) years' service in the specialized practice of pediatrics including connection with some pediatric activity.

Examination is required on all applicants in this group.

The Board defines service in a pediatric center as full time devoted to rounded experience in an acceptable hospital, or a graduate course which includes ward and out patient service including therapeutic and preventive pediatrics. The time served in pediatric centers need not be continuous or spent in the same institution.

The fee for certification was placed at \$20.00. This is less than half of the fee charged by the other specialty examining boards and may have to be increased.

A booklet is being prepared containing details, and, as soon as it is published, will be sent to every member of the American Pediatric Society and the American Academy of Pediatrics. There is no continuing or membership list of the Section of Pediatrics of the A M A. Pediatricians not members of the two societies should apply to the Secretary for a copy.

It should be kept in mind that the American Board of Pediatrics is not a medical society. It was founded by action of the three national pediatric societies.

mentioned above and is controlled by them as each appoints three members to the Board. The Board, therefore is merely the agent of the three national societies and its sole function is to issue certificates of proficiency in pediatrics. There are no dues. The certification fee is to pay for the actual work of the Board. According to the articles of incorporation no member of the Board may receive any salary, bonus, or emolument of any kind.

On February 11, 1934, The Advisory Board on Medical Specialties was organized at a meeting in Chicago. The following organizations are included in the Board. Each organization appoints two members to this Board.

- The American Board of Ophthalmology
- The American Board of Otolaryngology
- The American Board of Obstetrics and Gynecology
- The American Board of Dermatology and Syphilology
- The American Board of Pediatrics.
- The Council on Medical Education and Hospitals of the A. M. A.
- The Association of American Medical Colleges.
- The National Board of Medical Examiners.
- The Federation of State Medical Boards of the U. S. A.
- The American Hospital Association.

Boards are in process of formation in radiology, orthopedic surgery, gastroenterology, proctology and psychiatry.

Comments

IT HAS long been charged that mortality during pregnancy, labor, and the puerperium is high and unnecessarily high. Many studies of mortality statistics have been made, and little positive proof has been presented—at any rate proof acceptable to the profession at large. The basic facts on which these studies have been made are claimed to be inaccurate. The Report of the New York Academy of Medicine, prepared under the direction of Dr. Ransom S. Hooker, is the most careful and scientifically accurate collection of facts on this subject ever presented. After long study of the pitfalls and possible inaccuracies and with the advice of recognized statisticians, the assemblage and analysis of data of every maternal death occurring in New York City during the years 1930-1932 was undertaken.

During those three years 2,041 deaths occurred from conditions associated with childbirth. Data on each case were obtained within one month after death occurred by personal interview with the attendant concerned, and in hospital cases the bedside notes were also carefully studied. The facts were then assembled, and each month was studied by an advisory committee of four obstetricians of recognized ability and standing. The decisions were made without knowledge of who the attendant was in any case. It is well to emphasize the details, for the facts presented in the report are certainly startling. In the first place it demonstrated that studies of official death certificates do not give a true picture of the facts. There was an error in 17.8 per cent in stating the true cause of death. In 15.9 per cent of the cases no mention was made of the true cause of death, either as primary or contributory. This was particularly true of puerperal septicemia, in over 28 per cent of the cases this condition was never stated.

Of the 2,041 deaths 65.8 per cent were judged preventable. "That number of women, if they had had proper treatment and care, could and should have been brought safely through parturition." In only phlegmasia alba dolens and embolus and "accidents of puerperium" were the majority of deaths not preventable. And still more serious is the placing of the responsibility.

Of all these deaths judged preventable, in 61.1 per cent the responsibility was laid to the physician. In only abortion (nontherapeutic), albuminuria and eclampsia, and pernicious vomiting of pregnancy was the responsibility laid to the patient in the majority of cases. Of these preventable deaths laid to the physician, approximately half were due to errors of judgment and half to errors of technique.

Let it be remembered that these decisions were made by men of recognized ability and judgment, who were studying work in which they specialized. "Whenever there was doubt or disagreement, or where complete data on any cases were lacking, the judgment was 'not preventable'." It is perhaps wise to mention the basis on which this preventability was judged. "In judging whether or not the death was inevitable, the criterion was that of the best possible skill both in diagnosis and treatment which the community could make available."

The most frequent cause of death was puerperal septicemia, 25 per cent of all deaths! And this exclusive of abortion and ectopic gestation. It was almost five times as high following operative delivery as in spontaneous delivery. Of the preventable cases, 75 per cent of the total, almost 82 per cent were ascribed to errors

on the part of the physician errors of technic being almost twice as many as errors of judgment. The report states that the "reproach" to obstetrics that the incidence of puerperal septicemia has not materially lessened in these days of asepsis, as it has in surgery, is only partly deserved. The lower genital tract is always a potentially infected area, but the organisms there present are usually nonpathogenic until conditions are changed when they may become very virulent. These conditions are generally believed to be due to lowered resistance of the tissues from severe hemorrhage, shock, and tearing or bruising of the soft parts. In other words, poor obstetric technic. "The avoidance of this type of infection therefore, depends on good obstetric judgment and on the skillful performance of obstetric operations when they are indicated."

But the majority of the septicemia cases comes from hemolytic streptococci introduced by droplet infection of the hands and instruments by attendants who are carriers of these organisms. Infection from septic lesions on the hands or person of attendants is considered unusual. The type of infection in puerperal septicemia has therefore changed since the days of Semmelweis and Oliver Wendell Holmes, but the infection still occurs.

Hemorrhage was directly responsible for nearly 10 per cent of all the deaths, and of these over three-quarters were considered preventable. Of the preventable deaths, the physician was held responsible for over three-quarters, in this case errors of judgment being almost twice as frequent as errors of technic.

Accidents of labor, the cause of over 8 per cent of the deaths, were preventable in 8 per cent of the cases and the physician was held responsible in almost 90 per cent of them—his errors being about equally those of judgment and of technic.

Among the causes of deaths in which the patient herself was considered responsible more often than the attendant, the most frequent cause was albuminuria and eclampsia—over 11 per cent of all deaths—and here the blame was laid to the woman in 60 per cent of the preventable cases. "The studies of these cases revealed a surprising tendency to disregard manifest danger signals, very many of the women being first brought under observation at the time of the first convulsion."

To do more than touch the high points of this report is impossible. Every one of its 222 pages and 50 more pages in the Appendix is worthy of careful study by every obstetrician and every physician who takes obstetric cases, nay by every physician. The report emphasizes in much detail the lack of suitable prenatal care due to the ignorance of the laity of its necessity and too often the insufficient care given by the physician when it is sought. It states with utter frankness where the responsibility seemed clearly to lie for maternal deaths. Proper care was not given according to the report, in 65 per cent of the cases but where the lack of proper care was ascribed to failure on the part of the attendant it is probable that the failure was not attributable to neglect or carelessness. Rather the ignorance and insufficient training of the attendant prevented him from giving the high quality of care which he was attempting to provide for his patient and further prevented the understanding on his part of the fact that he was incapable.

That is the real crux of the situation, and we are back again to the frequent criticism that medical education is failing to teach the fundamentals in obstetrics, as well as in many other branches of medicine. The medical schools must give sufficient training in normal obstetrics, but they must do more. They must inform the student that the training which he receives does not qualify him to practice as a specialist in obstetrics. His training is to enable him to conduct normal labors and to be able to recognize and evaluate the abnormalities requiring the services

of a specially qualified obstetrician. The medical profession *must* insist that prolonged graduate study is necessary for specialization." Such opportunities must be made available and must be adequate.

The medical profession is equally obligated to teach the lay public what safe obstetrics is, that adequate prenatal examination and continued observation is essential, that the patient must be informed of the possible gravity of symptoms which may seem to her unimportant, that "operative delivery, undertaken merely to alleviate pain or shorten labor involves increased risk to both mother and baby."

The report also emphasizes that four walls, a roof, an operating room and a score or more of beds do not constitute a hospital. If honestly studied, its findings of hospital deaths point to the increased danger inherent in crowding together a number of patients unless the utmost care and attention is given to securing the most complete asepsis possible. It states that these conditions do not exist in a great number of the hospitals, especially the so called proprietary hospitals.

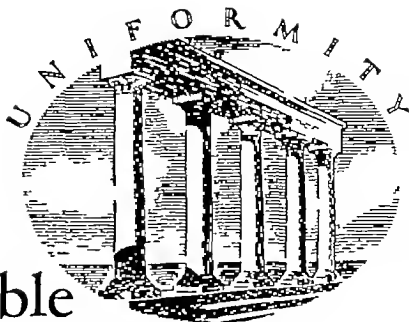
This report is the result of work done at the express desire of a large body of obstetricians. That it should be criticized by the incompetent is not strange. But what will the obstetricians as a whole do about it? It is the strongest argument yet produced for the necessity of certifying "specialists" and should be of the greatest assistance to the efforts of the American Board of Obstetrics and Gynecology. It is an honest, fearless, conservative statement of the results of a remarkable personal study of every death associated with childbirth in a community of six million people over a period of three years. It is worth careful study.

Erratum

In Dr Sweet's review of "The Diagnosis and Treatment of Postural Defects" by Phelps and Kipluth, in the December, 1933, issue of the Journal, p. 943, the sentence beginning on line 17 should read

"A moccasin is, I am certain, the only form of shoe for normal infants until the full development of skillful coordinated walking which does *not* interfere with the best development of the muscular power and functional skill of the feet."

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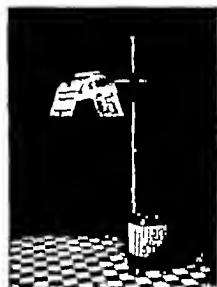
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In discussing the treatment of (decomposition) Feer says "The period of repair may be shortened by giving suitable additional food the best, probably being buttermilk to which carefully regulated proportions of dextrin and maltose preparations or malt soup are added —E Feer *Text Book of Pediatrics*, J B Lippincott Co., Phila., 1922 p 284

In the treatment of (infantile atrophy) Fischer recommends the following "The carbohydrate should be increased by gradual addition of dextrin maltose

"Malt soup or dextrin maltose (Mead's) should be added in teaspoonful or more doses to each feeding until the point of carbohydrate tolerance is reached —L Fischer *Diseases of Infancy and Childhood* F A Davis Co. Phila., 1925 1, p 297

Grulee, discussing treatment of (decomposition) observes "As a rule it is best to start with 2 to 2½ or 3 ounces of albumin milk to the pound weight in 24 hours the sugar to be added is in the form of a maltose-dextrin mixture One should never delay too long in adding this —C G Grulee *Infant Feeding* W B Saunders Co., Phila., 1922, p 265

Referring to the (hypotrophic infant) Herrman writes "In mild cases the addition of dextrin maltose instead of cane or milk sugar may be sufficient to obtain a gain in weight —C Herrman *The treatment of nutritional disorders in artificially fed infants* New York M J 114 158-160 August 1921

In discussing artificial feeding in (athrepsia) Hess states "The carbohydrates are usually added in a slowly fermentable form such as the maltose and dextrin compounds, which are usually started by the addition of four grams per kilogram (1/15 ounce per pound) and increased until eight grams or more per kilogram (½ ounce per pound) of body weight are added —J H Hess *Feeding and the Nutritional Disorders in Infancy and Childhood*, F A Davis Co. Phila., 1928 p 278

Concerning the treatment of (marasmus) Hill says "When the stools have become smooth and saive-like carbohydrate in the form of dextrin maltose, may be gradually added up to the limit of tolerance —L W Hill *Practical Infant Feeding* W B Saunders Co. Phila. 1922 p 281

"A (spasmophilic baby) on bottle feeding should receive a limited amount of milk—a pint, or at the most 24 ounces in the 24 hours—to which cereal gruel and some form of sugar is added preferably one of the malt dextrin preparations also the early addition of other foods than milk to the baby's

diet —W Jampolski *Infantile spasmophilia Interstate M J* 25 652, Sept 1918, *abst Arch Pediat* 35 691, Nov 1918

With reference to the treatment of (diarrhea) Lust writes "After several days 2% to 3% of a maltose-dextrin preparation may be added (Dextrin Maltose) This is preferable to the easily fermentable lactose or cane sugar —F Lust *The Treatment of Children's Diseases*, J P Lippincott Co. Phila., 1930 p 145

"The treatment of artificially fed children in the first of these groups consists in putting them on a low fat dietary, and giving them carbohydrate in the form of one of the less fermentable sugars—e.g. dextrin maltose —L G Parsons *Feeding disorders of early infancy*, *Lancet*, 1 687-694 April 6, 1924

Pearson and Wylie in discussing the treatment of milder cases of (marasmus) say "Regulation of this disturbed organismal balance is obtained by the addition of carbohydrates while fat and casein are reduced For this purpose dextrin maltose and flour are better than the ordinary sugars since they are more slowly absorbed and have greater efficacy in their powers of controlling the flora in the large intestine —W J Pearson and W G Wylie *Recent Advances in Diseases of Children*, P Blakiston's Son & Co., Phila., 1930 p 116

Regarding the treatment of the (marantic infant) Rame states "After the intolerance to sugar has been overcome a carbohydrate preferably Dextrin maltose may be added —C S Rame *Diseases of Children* Boericke & Tafel Phila. 1922 p 427

In discussing the treatment of (atrophy) Thursfield and Paterson state "If the baby continues to improve the next step in the treatment is to add to the milk one of the less fermentable carbohydrates such as dextrin maltose —H Thursfield and D Poterson *Diseases of Children* William Wood & Co 1929 p 105

"I also find dextrin maltose an excellent addition to albumin milk when the first object of that food has been achieved and a gain in (weight is desired) in this way I have succeeded in feeding albumin milk far beyond the period usually advised with highly gratifying results —F I Wochenheim *Infant Feeding, Its Principles and Practice*, Lea & Febiger, Phila. 1915 p 158

"Dextrin maltose has been substituted for lactose not infrequently, when the tolerance for the latter continues low —J H West *Low fat, high starch evaporated milk feeding for the (marasmic baby)* *Arch Pediat* 48 159-193, March 1931

"Malt sugar is indicated when others fail to produce a sufficient gain or when (malassimilation of fat) is evident —O H Wason *The Role of carbohydrates in infant feeding*, *Southern M J* 11 177 March, 1918 *abst Arch Pediat* 35 447 July 1918

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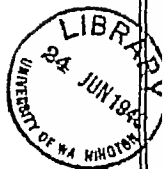
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Continued down from 1911

1920

There are three sugars commonly employed in infant feeding: (1) malt sugar or dextrin maltose, (2) cane sugar and (3) milk sugar. Malt sugar is the most easily digested and assimilated, cane sugar next and sugar of milk the least so. — *L. O. French, The caloric method of artificial feeding in normal babies, Illinois M J 33 48, 488 Dec 1920*

1920

Regarding treatment in disturbed metabolic balance in infants, The one carbohydrate which seems to give the most satisfactory results in these cases is malt sugar. — *C. H. Seybert, Disturbed metabolic balance in infancy, Hahneman Monthly pp 379-382 June 1920*

1921

Next to woman's milk is cow's milk in simple modification with water and sugar in proper proportions and amount according to the age of the child. Milk Sugar is the most expensive and least satisfactory sugar. Dextri Maltose is the best sugar. — *A. A. Shawkey, Infant foods and infant feeding, West Virginia M J 16 284-287 Feb 1921*

1921

With reference to hypotrophy. In mild cases the addition of dextrimaltose instead of cane or milk sugar may be sufficient to obtain a gain in weight. — *C. Herrman, The treatment of nutritional disorders in artificially fed infants, New York M J 114 183 100 Aug 1921*

1921

Maltose and dextrin compounds are acceptable to the infant's digestion in relatively larger quantities. They are not as sweet as cane sugar. They are of practical value when larger amounts of cane sugar are not well borne.

The so-called Mead's Dextri maltose with Potassium Bicarbonate is laxative and in the presence of a stationery weight may be given in larger amounts. — *F. H. Ferguson, A method for the modification of cow's milk, Journal Lancet 41-625-620 Dec 1 1921*

1921

For cases of fermentative diarrhea, the ideal plan of treatment would be to give a food which is low in sugar (the food which that group of organisms thrive on) and high in protein. Calcium caseinate milk accomplishes this purpose. In our series of cases we found it was necessary to use the casein calcium for from 5-8 days we then stopped it and added dextri maltose to the formula. — *A. G. DeSanctis and L. J. Pader, The value of calcium caseinate milk in fermentative diarrhea, Arch Pediat 33 233 238 April 1921*

1922

Lactose in reasonable amounts under normal conditions has a slight laxative action as does maltose while saccharose is slightly constipating. When given in excess lactase is more likely than the other disaccharides to cause diarrhea, the order being lactose, saccharose, maltose and dextrin maltose mixtures. The probable explanation of the greater frequency with which lactose causes diarrhea is its relatively slow absorbability.

There can be no doubt therefore that under normal conditions the preferable sugar for the well infant is lactose. This is not the case however in many of the disturbances of digestion. Some of these are due to an excessive amount of milk sugar in the food. They can be quickly relieved by a reduction in the percentage of milk sugar. In others while the disturbance is not due primarily to the amount of milk sugar the chief cause of the symptoms is the fermentation of the milk sugar as the result of abnormal bacterial activity. In such instances

the milk sugar must be stopped and some other form of sugar substituted for it.

The properties of maltose and the dextrans are markedly different. Maltose is a disaccharide, dextrans are polysaccharides. Maltose is a crystalline fermentable and dialyzable, the dextrans are reversible protective colloids, non fermentable and non-dialyzable. It is evident then that it is not a matter of little importance which of these preparations is used. All are of course eventually absorbed in the form of dextrose. The dextrans being protective colloids, in all probability have a favorable influence on the digestibility of the protein in the same way as does starch. Maltose has no such action. The dextrans have to be changed to maltose and then to dextrose before they are absorbed. The larger the proportion of dextrin in the dextrin maltose mixtures the slower therefore is the absorption of sugar and vice versa. There is consequently less danger of overtaxing the absorptive mechanism of the intestine and of flooding the organism with sugar when the proportion of the dextrans is relatively high. On the other hand if it is desired to give the sugar in a form which can be very readily and rapidly absorbed the proportion of maltose should be large.

Maltose is split into dextrose and dextrose which can be immediately utilized. Lactose is split into dextrose and galactose and saccharose into dextrose and levulose. Only the dextrose half of these sugars is therefore immediately available without further change. This immediately available half of the malt sugar is presumably of some advantage in feeble emaciated babies, who have little or no reserve of glycogen in the liver in that all of the energy derived from the sugar may be used immediately in the digestion of the rest of the food, whereas the energy of the other sugars is not at once utilizable, the galactose and levulose halves having to be converted into glycogen in the liver and then reconverted into maltose and dextrose. The net energy value of malt sugar is also presumably somewhat greater than that of lactose and saccharose because the sugar being converted at once into dextrose no further energy is required as there is to convert the galactose and levulose. The immediate utilizability of malt sugar is the chief point in favor of the employment of this form of sugar in the feeding of babies not suffering from disturbances of the digestion. This fact while of importance in the feeding of feeble and emaciated babies who have but little or no reserve of glycogen in the liver is of no advantage in the feeding of normal infants. In fact, it is probably somewhat of a disadvantage. Milk sugar which is more slowly broken up and more slowly stored in the liver in the form of glycogen is more suitable in that it is less likely to overtax the liver and cause alimentary glycosuria and excessive fat production.

There is a form of indigestion, chiefly intestinal, in infancy due to the fermentation of milk sugar. In the convalescent stage of this condition the dextrin maltose preparations can be given sooner than lactose without causing a return of the symptoms. Their use is therefore indicated in this condition. The preparations containing a relatively large proportion of dextrans are preferable because they are broken down more slowly.

Attention has recently been called to the use of polycarbohydrates in infant feeding. Those who use this term mean by it a combination of several carbohydrates in the same food. They believe that on account of the difference in the rapidity of absorption of the different carbohydrates more carbohydrate can be given in this way without overtaxing the power of the organism to assimilate and utilize sugar than when a single carbohydrate is used. This belief is unquestionably correct and there is no doubt that when there is a disturbance in the digestion of sugar it is of great advantage to give some of the carbohydrate in the form of starch. The mixtures of milk, dextrin maltose mixtures and simple cereal waters contain the carbohydrates in sufficient variety to meet the indications for the polycarbohydrates. The malt sugar is absorbed first, then the milk sugar next the dextrans and finally the starch. The absorption is thus comparatively slow and continues for a long time. The sudden flooding of the organism with sugar is thus avoided. — *J. L. Morse and F. B. Talbot, Diseases of Nutrition and Infant Feeding, Macmillan Co., New York, 1922 pp 206 207 208 209 213*

Continued down to 1934

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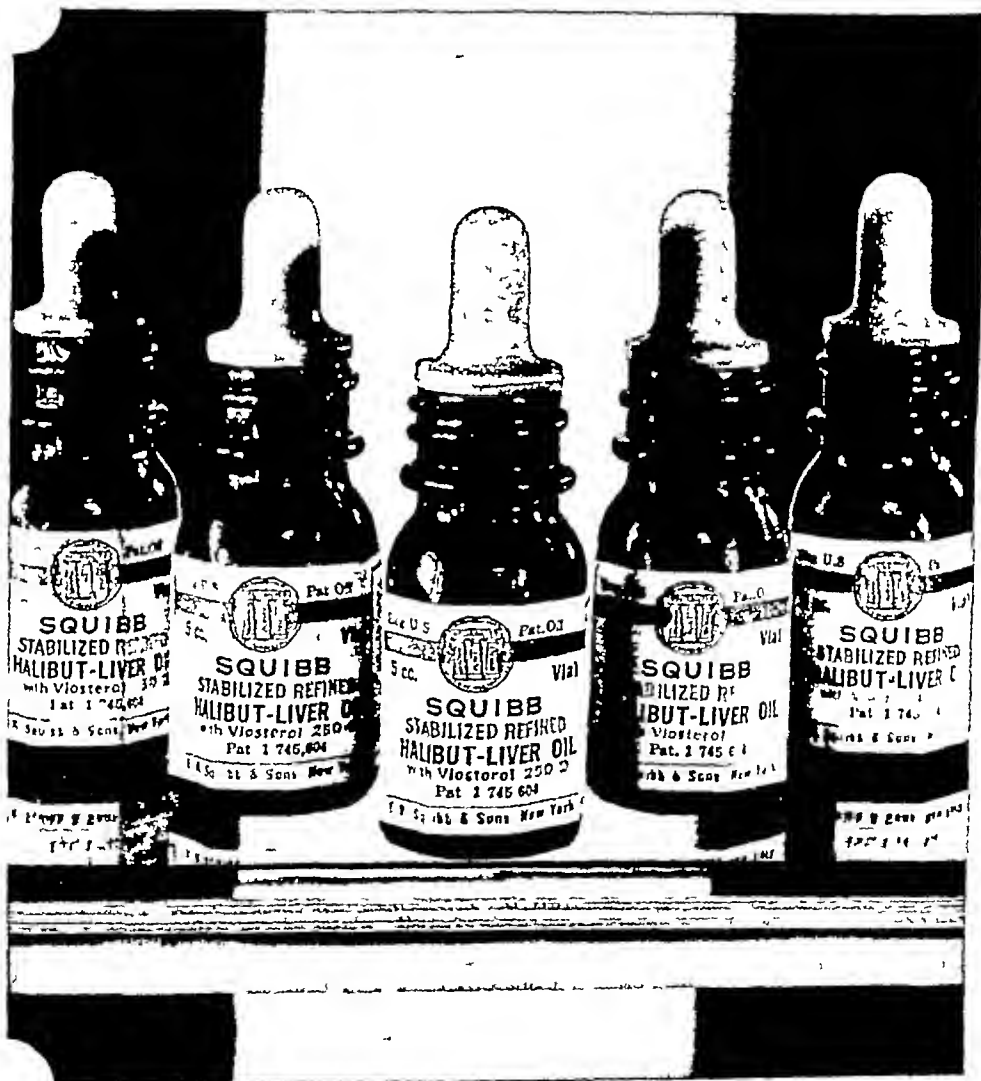
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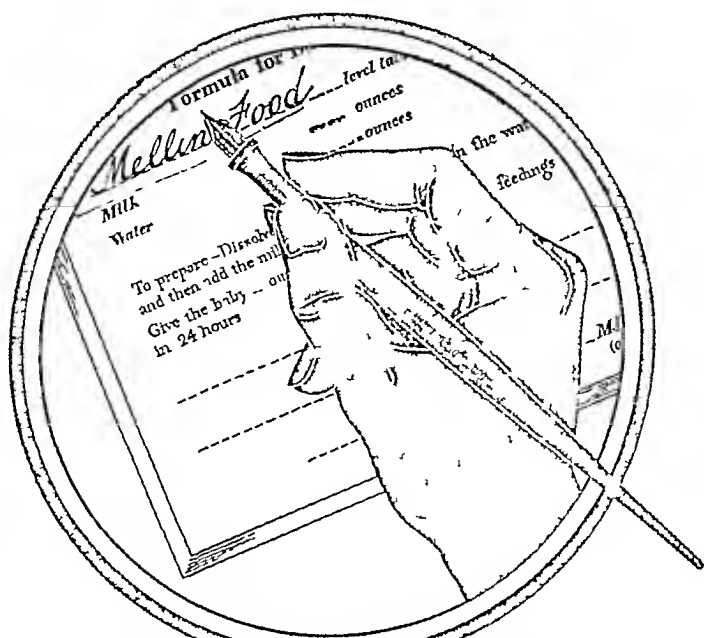
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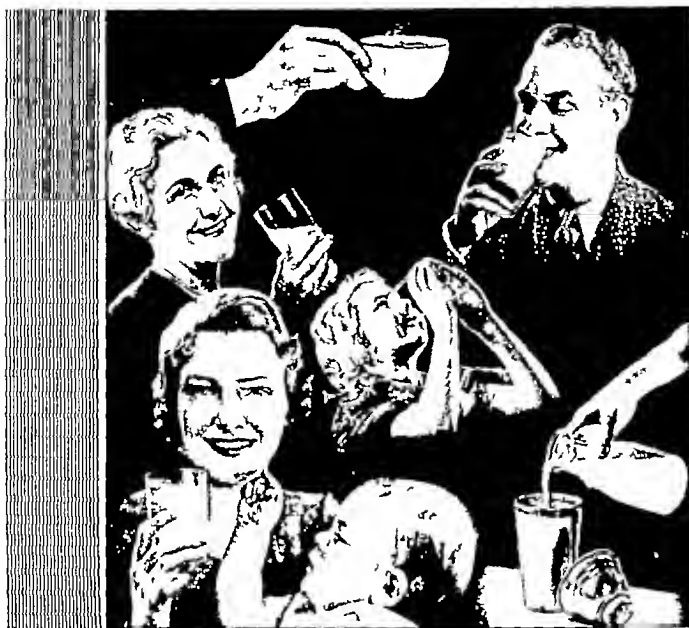
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Williams McKim Marriott, *Infant Nutrition* 151 (1930)

“The natural food of the infant is ***human milk** characterized by the fact that its quality **changes very little**, the infant's growth being dependent on the increase in the amount of milk secreted.”

Jullus H. Hess, *Feeding and the Nutritional Disorders in Infancy and Childhood* 7 (1930)

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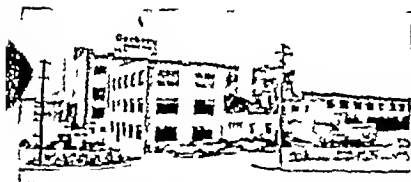
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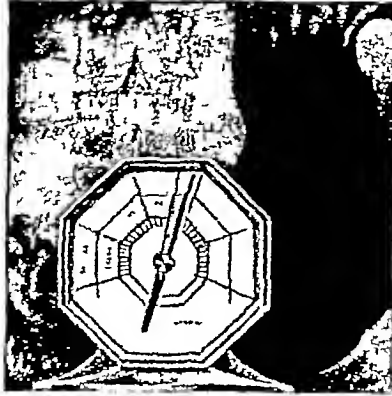
Maltose	30
Ash	0.5
Fat (ether ext. act.)	0.0
Hydrolyzed protein (N x 6.25)	0.05
Reduced sugars as maltose	50.0
Dextrins (by difference)	49.8
Level tablespoons, per ounce	4
Calories per level tablespoon	27½
Calories per ounce	110



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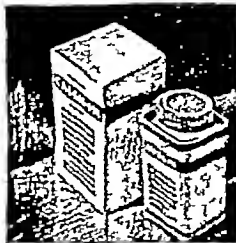
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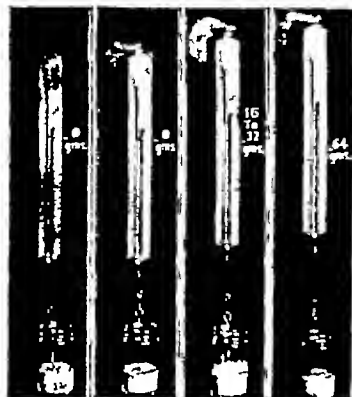
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FAT has a caloric value more than twice that of either carbohydrates or protein and serves very well to make up the necessary energy or caloric requirement. Two of the important vitamins, 'A' and 'D', are associated with the fat of milk and when the diet is low in milk fat these vitamins must be supplied in some other form."¹

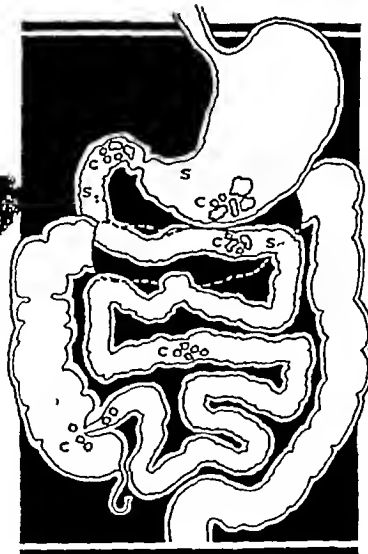
"When milk curdles in the infant's stomach it entangles a large proportion of the milk fat in its meshes and only such fat as lies near the surface of the curd can be reached by the digestive juices. The amount of fat in the curd depends upon the amount of fat in the milk."²

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The finer the curd the greater the surface area. The greater the surface area the more exposed are the fats, carbohydrates, proteins and salts to the digestive enzymes. Result—a more complete utilization of the food elements.

¹Marriott Infant Nutrition, pg. 49

²Talbot, Morse and Talbot, Diseases of Nutrition and Infant Feeding, pg. 48



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Schematic drawing of the relative size of the curds of cow's milk and Similac vomited by six weeks old puppies after one half hour's ingestion.

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SIMILAC—Made from fresh skim milk (casein modified) with added lactose, salts, milk fat and vegetable and cod liver oils.



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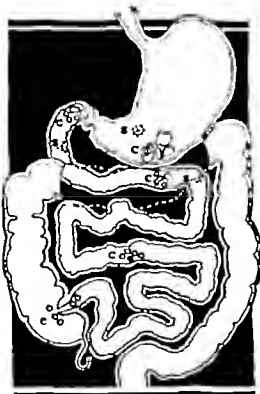
CURD TENSION

- AND INFANT FEEDING -

ITS EFFECT UPON THE ASSIMILATION OF CARBOHYDRATES



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THE curds of milk contain only a small amount of carbohydrates, sufficient, however, to be a disturbing factor in infant feeding.

"A large part of the digestion and absorption of the carbohydrates takes place in the upper part of the small intestine."¹

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The finer the curd the greater the surface area. The greater the surface area the more exposed are the fats, carbohydrates, proteins and salts to the digestive enzymes. Result a more complete utilization of the food elements.

¹ London & Paley: *Zeitschr f physiol. Chem.* 1906, XLIX, 122.

² Marriott: *Infant Nutrition*, pg. 81.

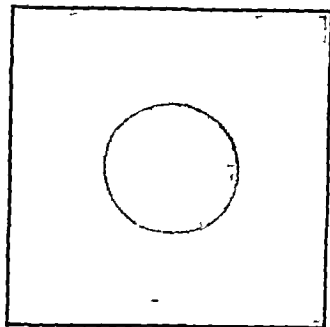
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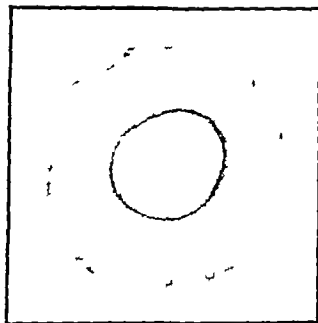


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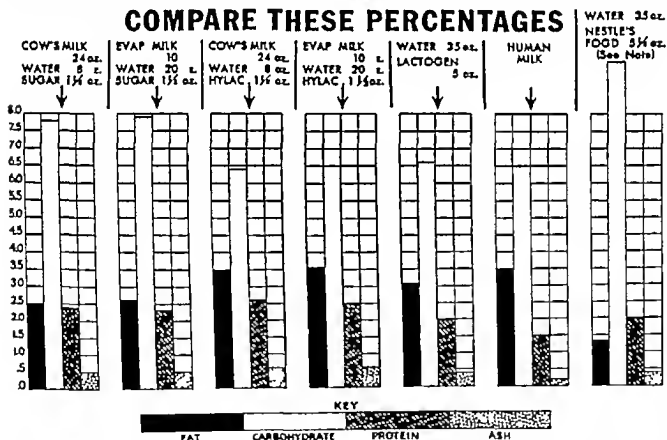
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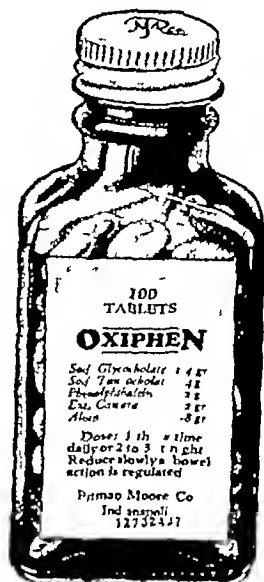
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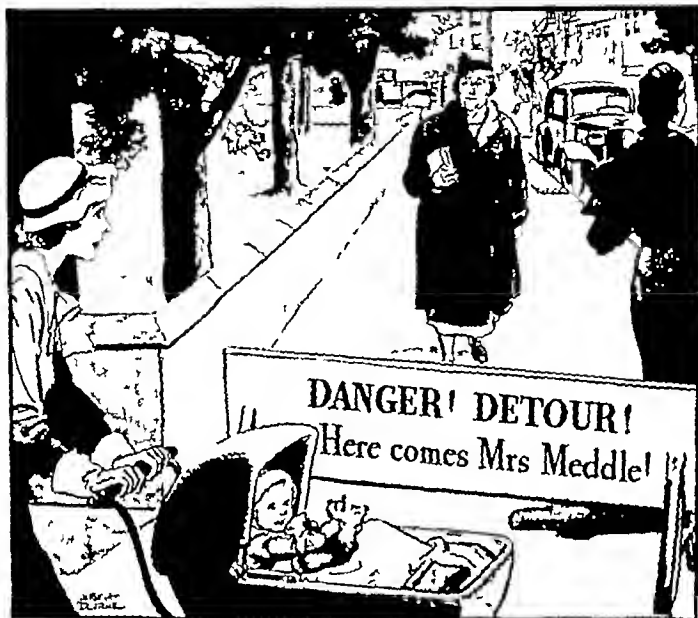
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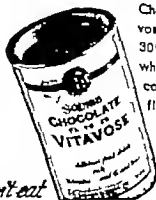
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"As to the kind of extra carbohydrate to be added whether lactose or maltose I believe dextrin-maltose to be better in general in cases of fat indigestion (infantile atrophy). —C H Dunn *The Hygiene and Medical Treatment of Children*, Southworth Co., Troy New York 1917, V 1 p 418

In discussing the treatment of decomposition Feer says 'The period of repair may be shortened by giving suitable additional food the best probably, being buttermilk to which carefully regulated proportions of dextrin and maltose preparations or malt soup are added. —E Feer *Text Book of Pediatrics*, J B Lippincott Co., Phila., 1922, p 284

In the treatment of infantile atrophy, Fischer recommends the following 'The carbohydrate should be increased by gradual addition of dextrin-maltose

"Malt soup or dextrin-maltose (Mead's) should be added in teaspoonful or more doses to each feeding until the point of carbohydrate tolerance is reached. —L Fischer *Diseases of Infancy and Childhood* F A Davis Co. Phila., 1925 I, p 285

Grulee discussing treatment of decomposition, observes 'As a rule it is best to start with 2 to 2½ or 3 ounces of albumin milk to the pound weight in 24 hours the sugar to be added is in the form of a maltose-dextrin mixture. One should never delay too long in adding this. —C G Grulee *Infant Feeding* W B Saunders Co., Phila. 1922, p 265

Referring to the hypotrophic infant, Herrman writes 'In mild cases the addition of dextrin-maltose instead of cane or milk sugar may be sufficient to obtain a gain in weight. —C Herrman *The treatment of nutritional disorders in artificially fed infants*, New York M J 114 158-160 August 1921

In discussing artificial feeding H. H. Hess states 'The carbohydrates are usually added in a slowly fermentable form such as the maltose and dextrin compounds, which are usually started by the addition of four grams per kilogram (1/15 ounce per pound) and increased until eight grams or more per kilogram (¼ ounce per pound) of body weight are added. —J H Hess *Feeding and the Nutritional Disorders in Infancy and Childhood*, F A Davis Co., Phila., 1928 p 278

Concerning the treatment of marasmus, Hill says "When the stools have become smooth and saive-like carbohydrate in the form of dextrin-maltose, may be gradually added up to the limit of tolerance. —L W Hill *Proctol Infant Feeding* W B Saunders Co. Phila. 1922, p 281

"A spasmophilic baby on bottle feeding should receive a limited amount of milk—a pint or at the most 24 ounces in the 24 hours—to which cereal gruel and some form of sugar is added preferably one of the malt dextrin preparations also the early addition of other foods than milk to the baby's

diet. —M Jompols *Infantile spasmophilic Interstate M J 25 632 Sept., 1918, obst Arch Pediat 35 691, Nov 1918*

With reference to the treatment of diarrhea Lust writes 'After several days, 2% to 3% of a maltose-dextrin preparation may be added (Dextri Maltose) This is preferable to the easily fermentable lactose or cane sugar. —F Lust *The Treatment of Children's Diseases*, J P Lippincott Co., Phila. 1930 p 145

The treatment of artificially fed children in the first of these groups consists in putting them on a low fat dietary and giving them carbohydrate in the form of one of the less fermentable sugars—e.g. dextrin-maltose. —L G Porsous *Feeding disorders of early infancy*, Lancet, 1 687-694, April 6, 1924

Pearson and Wylle in discussing the treatment of milder cases of inanition say 'Regulation of this disturbed organismal balance is obtained by the addition of carbohydrates while fat and casein are reduced. For this purpose dextrin-maltose and flour are better than the ordinary sugars since they are more slowly absorbed and have greater efficacy in their powers of controlling the flora in the large intestine. —W J Pearson and W G Wylle *Recent Advances in Diseases of Children*, P Blakiston's Son & Co. Phila. 1930 p 116

Regarding the treatment of the marasmic infant, Raue states 'After the intolerance to sugar has been overcome a carbohydrate preferably Dextri maltose may be added. —C S Raue *Diseases of Children Boericke & Tafel* Phila. 1922, p 427

In discussing the treatment of atrophy Thursfield and Paterson state 'If the baby continues to improve, the next step in the treatment is to add to the milk one of the less fermentable carbohydrates such as dextrin-maltose. —H Thursfield and D Paterson *Diseases of Children* William Wood & Co. 1929, p 105

"I also find dextrin maltose an excellent addition to albumin milk when the first object of that food has been achieved and a gain in weight is desired in this way I have succeeded in feeding albumin milk far beyond the period usually advised, with highly gratifying results. —F L Wachenheim *Infant-Feeding, Its Principles and Practice* Lea & Febiger, Phila. 1915 p 158

"Dextri-maltose has been substituted for lactose not infrequently when the tolerance for the latter continues low. —J H West *Low fat, high starch evaporated milk feeding for the marasmic baby*, Arch Pediat 48 189 193, March, 1931

"Malt sugar is indicated when others fail to produce a sufficient gain or when malassimilation of fat is evident. —O H Wilson *The role of carbohydrates in infant feeding*, Southern M J 11 177 March, 1918 obst Arch Pediat 35 447 July 1918

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The Journal of Pediatrics

VOL 4

APRIL, 1934

No 4

Original Communications

THE RELATIONSHIP OF HOME AND HOSPITAL IN THE MANAGEMENT OF SICK CHILDREN

A B SCHWARTZ, M D
MILWAUKEE, WIS

THE Committee on Hospitals of the White House Conference, of which Dr Grulee was chairman calls attention in its foreword to the change that has taken place in the fundamental character of children's hospitals. "In any study of what is being done for the health and protection of children, the hospital at once stands out as a very important factor. Our ideas as to its functions in this field have changed very materially during the past twenty years. *It is no longer simply an asylum where the sick person may be treated for his or her physical ailments*" (Author's italics.)

The original founding institution was a theoretical haven of refuge for the abandoned infant. Society, moved by the pathetic scene created a substitute for the home that should have sheltered its own young. Still moved by the same generous impulse, the hospital of the present day has responded to the spirit of the scientific age. Our operating rooms and laboratories exhibit the last word in equipment and scientific method. Undergoing this change we are apt to maintain an interest in sick children as roentgenographs and biologic problems and lose sight of their human qualities thinking of our patients as subjects of experiments in vitro and failing to realize that they are not in reality glass-enclosed problems but part of the homes from which they come and to which they go.

Our internes are particularly unresponsive to this phase of pediatrics. The average pediatric interno has a blind spot toward the social service report. The family history reading 'F' and M. L. and w 3 B and 1 S 1 and w could not be decoded into an intelligible family background by S S Van Dine himself. It no more describes the Mexican family, one of whose members had tuberculosis of the bone, than the "Count

fours" of the military squad identified its members. The laconic and stilted phraseology of the average clinical history is neither informative in its content nor does it possess the wit that brevity parades. The report of the British captain sent to govern a South African tribe was a mine of information in comparison. He was asked to record in his report a chapter on the customs and morals of the people. He wrote four words: "Customs, beastly. Morals, none."

In our private practice, our therapy is varied and relates itself to a particular home situation. Ingeniously, we blend scientific procedure with human understanding. The paradox is all the more surprising, that in our hospital work we delegate the study of the home to a social worker whose report we proceed to treat with disinterested remoteness.

More grievous still is the notion handed down from one interne staff to another that every sick child belongs to the hospital, and that the home is incapable of handling the sick child. This fallacy is reflected in the attitude taken by internes when a child is taken home before it has been officially discharged. The phrase "Discharged against advice" with all its implications characterizes a practice that is regarded as almost the worst kind of *lese majesté*.

H. G. Wells in "The New Machiavelli" described a character as having the temperament that would cut down trees and put sanitary glass lamp shades in their stand—and something of this spirit seems to direct us in our attitude to the relationship of institution and home in pediatrics. For purposes of illustration, I would like to submit a characteristic case history.

D. S., an eighteen-month-old infant, is admitted to the Milwaukee Children's Hospital with an unexplained fever and cough of some duration. A roentgenogram, tuberculin test, and physical examination establish the diagnosis as tuberculous bronchopneumonia. The child lies listlessly in his crib, coughs occasionally, continues to run an irregular fever. He is given cod liver oil, and all that a hospital can give, but he does not seem to respond. The mother is unintelligent, noisy, dowdy. The father helped win the war, was gassed and draws a small pension. He is otherwise unemployed. The mother would like to take the child home. She lives in a shack on the outskirts of the city. She is willing to put the baby outdoors and follow instructions. The interne has a long argument with the mother, but the mother takes the child home against advice.

In the middle of July this child was taken home. He was placed in a play pen, stripped. He gained weight, lost his fever, and when he came back to the out-patient department after two weeks showed a truly remarkable improvement. Since that time he has had a cervical adenitis, which he weathered equally well as an out-patient. The nursing follow-up on this patient had much to do with the cooperation obtained and the end result achieved.

It so happened that this infant's home was a shack on the outskirts of the city. The shack, situated at the edge of town had no other houses around it. Acres of ground grass and trees surrounded it. With proper social service and nursing follow up, such a home was an ideal place for this infant far superior in this instance to the well-ordered appointments of the hospital ward.

At the time this patient was being observed, we were experimenting with the plan of handling as outpatients a group of children that would ordinarily have been hospitalized. This program involved no great departure from any children's hospital's ordinary routine. It attempted a more intensive home follow up, using the Speedwell program as the ideal. It differed from the Speedwell plan in that instead of foster homes we utilized the patient's own home in the majority of instances. It attempted to project the usefulness of the hospital into the home and enlarge the function of the hospital by the home education resulting from the nurse's visits. The primary reason for our interest in the plan was the experience of a distressingly high mortality rate among certain groups of infants.

I will not take your time longer than to mention that from your own group have come some of the most valuable contributions to this idea that hospitalization of infants may not always be the happiest solution for the sick infant. Read Abt talking before the Children's Hospital Association in 1925, regarding the dangers of massing infants in hospitals and his practical suggestion 'keeping those babies at home where conditions permit them to remain at home.' Read Brennemann speaking before the American Pediatric Society. 'No patient should be admitted to an infant ward who can with reasonable assurance be taken care of in an outpatient department or in a good home or foster home. Our own infant wards of thirty beds in a 285 bed hospital are rarely full often only half full, and at times get down to six or seven patients. Only about 10 per cent of our patients are under eighteen months of age. Especially to be excluded are boarders and infants with infectious of the respiratory tract and gastrointestinal disorders that are not immediately serious. If you would be stirred read Jacobi, like a gladiator making his last stand before the lions in the Nursery and Child's Hospital episode of his *Collected*. The same tone of conviction you will find in Chapin writing of the Speedwell though not keyed to such a pitch.

Progress said Sir Clifford Allbutt in his delightful talk on Professional Education consists not only in anticipation of new ideas but also in timely apprehension of the passing of them and a readiness to shed them betimes not catastrophically but as a growing tree sheds its leaves. Otherwise we lose sight of their main form we muddle on

and finding ourselves houseless, know not how to rebuild, how to convert old materials to new needs "

The analogy is not a perfect one, because as far as materials go, our institutions are conspicuously new. In the use of these new techniques, we have spared neither cost nor effort to make them available for every sick child. Our confusion derives from the fact that in our clinical enthusiasm we become so interested in the case that we forget the larger implications of our medical tradition—that medicine was human before it was scientific.

The new need then demands neither new tools nor technique. It merely calls for the application of those principles that we utilize every day in our private practice. More than any one thing, we need to modify our conception of the relationship of home and hospital. The institution cannot exist as an isolated agency. Whatever remedial work it does must not be done merely for today but must relate itself to the whole child. Caring for the infant without teaching the mother how to do it is like Sisyphus, forever rolling up the mountain the stone that keeps rolling back. However inspired its motives, the institution whose program does not include the home misses a most important function—that of education.

If the hospital for children is to maintain its position as a health agency in the community, it must possess a more dynamic relationship to the family than is afforded by the polite contacts of nurse, interne and parent in the hospital ward.

To achieve this relationship, we should do well to accept the suggestion made to other social agencies by Mary Richmond. "The one practical suggestion that I can make to you," she said, "is that you ransack all your work for a year say, from top to bottom with reference to its influence upon the particular families from which your beneficiaries have come and to which they go. Examine every admission to your institution and every discharge from it with reference to this central fact."

It means reinterpreting the purpose of the children's hospital in terms of present-day conditions—integrating its activities with those of every agency that deals with any phase of child health.

"May the hospital of the future," says Carpenter, "need fewer ward beds for sick children, and may these be chiefly used for children requiring special diagnostic procedures."

Carpenter suggests a department of preventive medicine in every children's hospital. The natural outgrowth of such a department would be from the out-patient department, utilizing already existing machinery necessary in its development. In the usual out-patient department, social service workers and nurses visit the home and record their findings. Such home visits should not be restricted to these workers. The resident or interne learning modern pediatrics could not put in a more useful serv-

ice than in one which actually requires his following patients into their homes.* This procedure more than anything else, would develop the sociologic understanding so often missing among young pediatricians.

It is important for admitting internes to learn that the child with a case of simple diarrhea or sore throat is not necessarily a hospital case, that they learn to utilize the home for the sick infant or child whenever it is possible keeping the responsibility of the child's care where it belongs, that they send any infant or child into the hospital only when ever a special technic unavailable in the home is indicated and most important of all, that no matter how successful a hospital therapy may be it cannot be permanent unless the home from which the child comes is prepared to follow the plan initiated in the hospital

In summarizing the social trends of the past thirty years as related to childhood, Lawrence K. Marsh says, 'The child welfare movement is being impeded by the rigidity of the organizations, the lack of real concern for the well being of children they have under their care, and inability to correlate the several parts of the work into a coherent problem

There is need for a rededication of these various agencies to the task of child welfare and a keener realization of their responsibilities to the whole child "

In treating the whole child the children's hospital must project its interest outside its own physical walls and include the home from which the child comes. Sensitive to its original humanitarian purposes, it will enlarge their value by a technic that embraces the teachings of biology and sociology

2018 EAST NORTH AVENUE

*Such a service has recently been inaugurated as part of the Newborn Service at the Rush Medical College, by Dr. Grulee.

ERYTHRODERMIA DESQUAMATIVA

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IN ANY large series of eczematous infants there are some whose skin condition is characterized by a diffuse and intense redness with scaling, sometimes with extensive exfoliation. This was first described by Lemer¹ in 1908, who gave it the name "erythrodermia desquamativa." Since then a good many reports of series of such cases have appeared in the German and in the Italian literature but as far as I know the only discussion of it in the American literature is a brief paper in 1930 by Greenthal,² who reported one case. According to the German authors, it is a disease especially of breast-fed infants in the early months of life. In Lemer's original series of forty-three cases, forty one were breast fed, in Wittmann's³ fifty-six of seventy-four, and in Moro's⁴ one hundred and four of one hundred and thirty-four. The mortality rate is high, according to most authors from 16 to 50 per cent, although Schoenfeld⁵ in a recent report had a mortality rate of only 7 per cent. Diarrhea is common, and nutrition is likely to be poor.

Most of the German and Italian authors admit they know nothing of its etiology. Moro, however, believes that it is caused by lack of a special vitamin, which he calls the "H vitamin," in combination with a relatively high intake of fat in the breast milk. The reason that the disease is more common in breast- than in bottle fed infants, is, he believes, that breast milk contains less of the vitamin, or "minimal substance" as he calls it, than does cow's milk. There is no uniformity of opinion as regards treatment. Moro regards the addition of cow's milk liver, and carrot juice to the diet, as specific, for they contain relatively large amounts of vitamin H. Schiff,⁶ however, says that "through no form of vitamin therapy is it possible to do any good what ever to an erythrodermic child." One author recommends repeated small transfusions, another autohemotherapy, another, pituitary injections. Wittmann³ says that there are too many methods of treatment for any of them to be of specific value, and admits he knows nothing about it. Hirsch,⁷ likewise, admits he knows nothing whatever of etiology and says that time is the most important factor in cure.

From this brief review it is evident that erythrodermia desquamativa is a fairly common condition in Germany, that varying modes of treatment have been recommended and that very little is known of its etiology.

It is undoubtedly less common here than there, and it also differs as it occurs here, in certain respects from the German descriptions.

In a series of approximately 800 cases of "infantile eczema," I have seen only twenty-one which fit into the erythrodermia group. The appearance of the skin is quite characteristic, and diagnosis is not difficult in a typical case. The entire skin surface is very red, never very dry, possibly somewhat moist in spots, but rarely with much oozing, and



Fig 1—Erythrodermia, good nutrition.

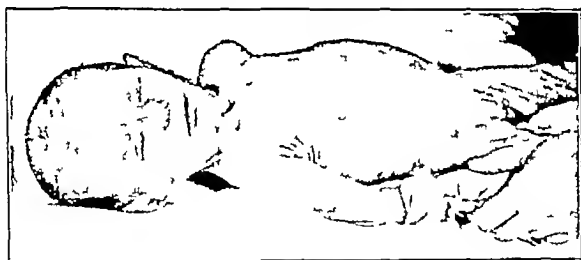


Fig 2—Erythrodermia, poor nutrition. Note scaling on cheeks and enlarged lymph nodes in groin.

consequently little crusting (Fig 1). In some cases there may be almost no scaling and the skin may be simply fiery red all over with otherwise a fairly normal appearance; in others there may be a fine branny desquamation. There is usually considerable scaling, however, and sometimes extensive exfoliation. The scalp is almost always covered with yellowish scales and crusts. One thing that I have not seen mentioned by other authors is blueness of the hands and feet. In twelve of our patients this was present. They were very cold, blue and clammy.

and as the infant began to get better, if he did get better, this disappeared. The nutrition in my patients varied, some were practically athreptic, others in an excellent state of nutrition (Fig 2)

According to many dermatologists, if one wishes to make a narrow definition of eczema, it is that in true eczema there are always vesicles, or at any rate papulovesicles. Vesiculation is absent in erythrodermia, and the skin is smooth as a rule. In some cases the entire body is not red, but perhaps only the feet, legs, and buttocks, as far as the waist, or sometimes the redness may be of a patchy character, occurring in large or small maculopapules, which soon coalesce.

This is definitely a disease of early life, eleven of my cases began before the end of the second month, one only as late as the sixth month. Only three were breast fed when the disease began, the others were on ordinary milk mixtures, and in practically every case the feeding had



Fig 3.—Patient A. S. Partial erythrodermia. Before treatment.

been a reasonable one, such as any capable pediatrician would give to a baby. In two cases diarrhea was a prominent symptom, in the others the bowel movements were normal. In six the disease began when the baby was weaned from the breast to the bottle. Two patients died, a mortality rate of about 9 per cent. They died with what was apparently severe general infection, localized in the respiratory tract. Several others developed respiratory infections, these babies are very susceptible to such infection and do not stand it well.

It is not easy to make skin tests on these patients, for frequently the skin is in such a condition that practically no normal skin is available. Skin tests were made in fourteen cases, six gave positive reactions. Four gave reactions to egg and to nothing else, one to wheat and tomato, one to wheat and chicken. In no case was there a reaction to anything that the child had eaten or was eating. There were no positive reactions to milk.

It is evident that this disorder is of systemic origin, and that no local treatment will cure it. After trying various washes and salves, I have come to the conclusion that there is nothing any better than borie ointment. This tends to prevent infection and to remove scales. Crude coal tar is contraindicated almost always, it is too strong, inasmuch as there is ordinarily little infiltration of the skin.

The basic process in erythrodermia desquamativa appears to be a dilatation of the small cutaneous vessels, and the most reasonable assumption is that this is brought about in some way from the digestive



Fig. 4.—Patient A. S. Partial erythrodermia. Before treatment.

tract. For this reason I have tried various diets but with very little preconceived idea as to what might prove of value. Evaporated milk and Similac were used in several cases because of their easily digested protein. No results were noted. Three patients were given liver juice and carrot juice for the vitamin H which they are supposed to contain. This feeding had no effect. Seven patients were given a milk free diet relatively low in fat and carbohydrate and high in protein, four of these were cured, one in a week the others in about a month. In the three other cases the milk free diet had no effect. One case was cured by weaning from the breast to a cow's milk formula. The most recent type of feeding that I have used, following the suggestion of Gvörgv*

is a cow's milk formula relatively low in fat and carbohydrate and high in protein. This is made of partially skimmed milk, added carbohydrate, and five level tablespoonfuls of powdered casein to the quart. This has been used to date in six cases. Four were cured in from four to six months, one is at the present greatly improved, and one is not at all improved after two months of this feeding. I should not be willing to

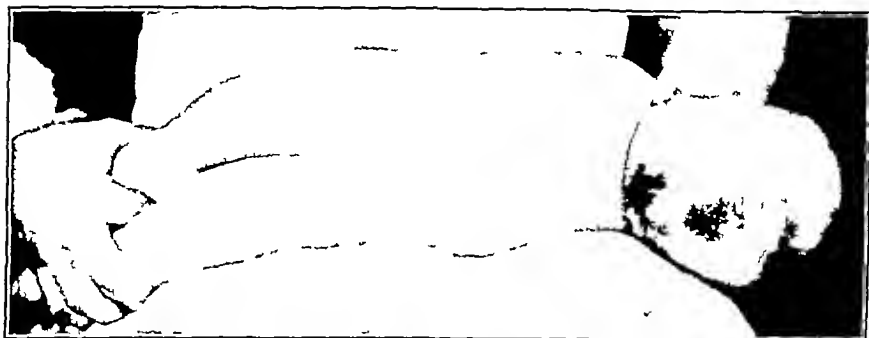


Fig 5—Patient A. S. After three weeks of low fat and high protein diet.



Fig 6—Patient A. S. After three weeks of low fat and high protein diet.

say that this method of feeding is a specific cure, but it has given the most consistently good results of any I have yet tried, particularly in cases of partial erythrodermia (Figs 3, 4, 5 and 6). The milk free diet, which was successful in four cases, is also low in fat and carbohydrate and high in protein, and it is likely that this is the reason it was successful, rather than that the patients were sensitized to cow's milk.

Where does this condition belong in classification? The Heidelberg school (Moro and Gvorgy) believes that it is a greatly intensified

seborrheic dermatitis this is probably correct, for all gradations may be seen, and there are practically always well-defined seborrheic scales. The relationship between seborrheic dermatitis and eczema in infancy is not at all clear for in so many cases, one merges into the other. Seborrheic dermatitis is defined as an eruption which is characterized by more or less sharply circumscribed areas of dermatitis with seborrheic scaling. It occurs frequently during the early months of life and very often becomes eczemized, that is, vesiculated and thickened, when it is called seborrheic eczema. It is certainly in young infants often the precursor of true eczema: the infants who show a tendency to seborrheic manifestations in the second or third month are the ones who develop true eczema with positive skin tests at the sixth or seventh month so that most of the time it is not possible to make a clear distinction. In clean-cut cases the skin tests are likely to be negative particularly in very young infants. As the baby grows older, they are more likely to be positive, consequently it would seem reasonable to look upon many cases of seborrheic dermatitis, although not in their clinical appearance characterized by the vesiculation of true eczema, as the first stage of eczema. If erythrodermia desquamativa is seborrheic dermatitis (and it seems likely that it is), they both bear the same relationship to eczema. I believe that they occur sometimes in allergic and sometimes in nonallergic children and that the particular way in which the skin reacts, that is by diffuse redness and scaling, is determined by constitutional and nutritional factors of which we know but little. It seems well to look upon erythrodermia desquamativa not as a distinct disease but rather as a symptom-complex occurring in certain seborrheic and eczematous infants, for it is not possible to give it an entirely clean-cut and sharply defined place in classification.

We are perhaps justified in drawing the conclusion that this particular symptom-complex is favored in its development by a diet relatively high in fat and sugar and is retarded by a diet low in fat and sugar and high in protein. At present, I do not believe we can go further than this in any consideration of etiology.

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RICKETS IN RATS BY IRON FEEDING

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AND

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INTRODUCTION

THE studies reported here were undertaken in pursuance of some ideas arising out of preliminary experiments bearing upon the problem of the absorption of iron¹. It was found that the dialysis of ferrie ammonium citrate across cellophane membranes was markedly impeded by the addition to the solution of the secondary and tertiary sodium phosphates, even though there was no precipitate. This effect was considered to be due to the formation of colloidal ferrie phosphate. Other soluble iron salts used in these dialysis experiments all formed precipitates with secondary and tertiary sodium phosphate under the conditions of the experiment, and the passage of the iron salts was naturally greatly impeded. The supposition that these principles might be applicable to conditions in the intestinal tract suggested the possibility that iron and phosphorus might, by forming insoluble compounds in the intestinal tract, each hinder the absorption of the other.

It was decided, therefore, to find out whether in the case of rats the addition of iron to a nonrachitogenic diet might so interfere with the absorption of phosphorus as to render that diet rachitogenic.

EXPERIMENTAL

Young rats were obtained from the Albino Supply Company of Philadelphia. They were of the type called by the suppliers "vitamin rats," recently weaned, and weighing between 35 and 50 grams.

The rats were divided into groups of five to a cage, all being exposed to the same amount of daylight coming through a plain glass window facing north.

Particulars are given in Table I of the various diets used.

The Control Diet used is one which has repeatedly been shown to be nonrachitogenic to rats.

The Steenbock Rachitogenic Diet is a high calcium, low phosphorus diet, which has repeatedly been shown to be rachitogenic to rats under conditions similar to those which were used for our animals. *Each of the remaining diets consists of the control diet plus the various substances mentioned.*

From the Departments of Pediatrics and Medicine, Harvard Medical School and the Thorndike Memorial Laboratory, Second and Fourth Medical Services (Harvard) of the Boston City Hospital.

*Leverhulme Research Scholar of the Royal College of Physicians, London.

TABLE I

TYPE OF DIET	INGREDIENTS IN GRAMS	Ca (gm)	P (gm)	RATIO Ca P	ADDED Fe (gm)	REMARKS
Control	Corn meal 760 Wheat Gluten 200 Sodium Chloride 10 Calcium Carbonate 30 Dibasic Sodium Phosphate 16 (anhydrous)	12.4	6.0	2.1		
Steinbock Rachitogenic	Corn meal 760 Wheat Gluten 200 Sodium Chloride 10 Calcium Carbonate 30	12.4	5.5	2.1		Steinbock Rachitogenic Diet No 2905
Ferric Chloride	Control Diet plus $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ 44	12.4	6.0	2.1	0.14	9.14 gm of Fe combine chemically as ferric phosphate with 5.06 gm of phosphorus, or as ferrous phosphate with 3.37 gm of phosphorus
Ferric Chloride and Added Phosphorus	Corn meal 760 Wheat Gluten 200 NaCl 10 CaCO ₃ 30 Na ₂ HPO ₄ (anhydrous) 42.5 $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ 44				9.14	This diet contains 26.9 gm of Na_2HPO_4 more than the control. This represents 5.07 gm of phosphorus which is sufficient to combine chemically with the 9.14 gm of iron as FePO_4 .
Ammonium Chloride	Control Diet plus NH_4Cl 20.4					20.4 gm. NH_4Cl contain the same weight of chlorine as 44 gm. of $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$
Ferric Ammonium Citrate	Control Diet plus Ferric Ammonium Citrate .31				9.14	Same content of metallic iron as the Ferric Chloride Diet
Ferrous Chloride	Control Diet plus FeCl_2 19.3 (anhydrous)				9.6	Approximately same content of metallic iron as the Ferric Chloride Diet
Reduced Iron	Control Diet plus Ferrum Reductum (U.S.P.) 15					Approximately same content of metallic iron as the Ferric Chloride Diet
Organic Iron	Control Diet plus Ferric Glucamate 91.4					A proprietary organic iron preparation containing approximately 10% metallic iron

The Ferric Chloride Diet contains iron (9.14 gm) sufficient to combine chemically as ferric phosphate with 5.06 gm of phosphorus, or as ferrous phosphate with 3.37 grams of phosphorus. Iron in the above quantity was added to the control diet on the assumption that, by forming in the intestinal tract insoluble ferric or ferrous phosphate, it might interfere with the absorption of phosphorus.

The Ammonium Chloride Diet contains the same weight of chlorine as is contained in the ferric chloride present in the previous diet. It was intended to eliminate the possibility that any rachitogenic effect of added ferric chloride might be due to alterations in the hydrogen ion concentration of the contents of the intestinal tract or to the chlorine radical.

The Ferric Chloride and Added Phosphorus Diet contains in addition to the phosphorus already in the ferric chloride diet a further allowance of phosphorus, sufficient to combine as ferric phosphate with all the added iron, and thus provide the same amount of "unbound" phosphorus as the control diet.

The Ferric Ammonium Citrate, Ferrous Chloride, Reduced Iron and Organic Iron Diets consist each of the control diet with the addition of the salt named, in amount sufficient to yield about the same weight of metallic iron as is contained in the ferric chloride diet.

The diets were made up in the following manner. Each of the salts was finely ground in a mortar and intimately mixed in a large bowl with dry corn meal and wheat gluten. The mixture, after the addition of sufficient water to make it cohesive, was rolled out upon a piece of smooth paper which had been greased with olive oil, cut into small sections, and baked until crisp in an oven. In the case of ferric chloride and ferric ammonium citrate, these salts were dissolved in the amount of water which had to be added to the mixture. Water and food *ad libitum* were supplied fresh each day.

The control diet and the ammonium chloride diet were very well taken and the rats gained weight well and remained sleek and healthy. The Steenbock rachitogenic diet, the ferric chloride diet, the ferric chloride with added phosphate diet, the ferric ammonium citrate diet, and the ferrous chloride diet were moderately well taken. The animals appeared in good health but gained little weight. The reduced iron diet was less well taken and the animals lost weight. The organic iron diet was obviously hard and unpalatable to the rats. Although the animals on this diet appeared to be in moderately good health, they lost a great deal of weight. In spite of loss of weight in the last two groups all the animals obviously increased in skeletal stature. There was no noticeable diminution of activity nor weakness of the extremities.

The rats were weighed individually at the start of the experiment, and again from time to time throughout the duration of the experiment. After ten days or a fortnight they were lightly anesthetized with ether and radiographed to detect the development of rickets.

At the termination of the experiment, the animals were anesthetized, decapitated and as much blood drained out of the body as possible. The blood from each group was pooled, and the serum phosphorus estimated by the method of Fiske and Subbarow.² Each carcass was then radio-

TABLE II

GROUP NO	NO. OF RATS IN GROUP	DIET	NO OF DAYS ON DIET	AVERAGE CHANGE IN WEIGHT (gm)	POOLED BLOOD PHOS PHORUS (MG %)	DEGREE OF RICKETS REPORTED BY ROENTGENO GRAM	DEGREE OF RICKETS REPORTED BY MICROSCOPIC STUDY OF SECTIONS
1	5	Control	22	+ 5.2	7.3	None	None
2	5	FeCl ₃	22	+ 2.0	2.0	Advanced active	Severe active quantitatively more severe than that seen in any of the other groups
3	5	NH ₄ Cl	22	+ 4.0	7.2	None	None
4	4	Steenbock	22	+ 1.75	3.7	Advanced active	Severe active
5	5	Control	20	+ 9.8	5.7	None	None
6	5	NH ₄ Cl	27	+10.6	7.8	None	None
7	4	Steenbock	27	+ 4.0	2.6	Advanced active	Severe active
8	5	FeCl ₃ + added P	27	- 0.0	6.2	None	None
9	5	Fe Am. Citr	27	- 1.8	3.8	Mod. advanced active	Mod. severe active, less than FeCl ₃
10	5	FeCl ₃	26	+ 0.4	2.7	Mod. advanced active	Mod. severe active less than FeCl ₃
11	4	Fe Reduct.	26	- 4.0	3.6	None	Active mod severe
12	4	Organic	20	-12.75	5.6	None	None

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Fig. 2.—Steenbock rachitogenic diet active rickets section of costochondral junction (X104)



Fig. 3.—Ferric chloride diet active rickets section of costochondral junction (X104)

lent in metallic iron content to that of the ferric chloride diet. All the rats in these two groups showed rickets almost as severe as that of the members of the ferric chloride group although the diets were not as well taken and the rats failed to gain weight.

The members of Group 11, fed on a diet containing ferrum reductum, took their diet very poorly and lost weight. In Group 12, which received a diet containing organic iron, the loss of weight was even more pronounced. In these two groups the gross evidences of rickets were lacking. These findings are quite compatible with the well-known requirement of growth for the production of experimental rickets. In fact, it has been shown that cessation of growth resulting from starvation may readily heal the lesions in animals previously rachitic.³

The degree of rickets present in the roentgenograms of each group was assessed by Dr. Edward C. Vogt,* without prejudice of previous knowledge of the diets. His reports as shown in Column 7 of Table II stated that severe active rickets was present in the members of Groups 4 and

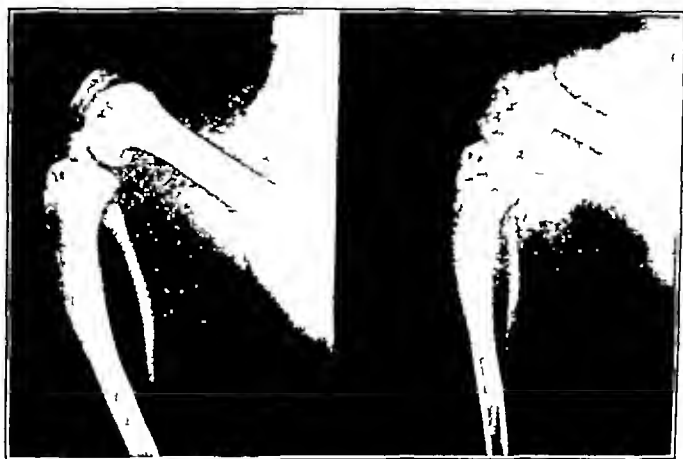


Fig. 4—Roentgenograms of lower extremity. Left. Control no rickets. Right. Ferric chloride diet advanced active rickets.

7 (Steenbock rachitogenic diet), Group 2 (ferric chloride diet), Group 9 (ferric ammonium citrate diet), and Group 10 (ferrous chloride diet).

CHEMICAL ANALYSES

In Column 6 of Table II are summarized the estimations of serum phosphorus on the pooled blood from each group. The serum phosphorus of all the groups showing no evidence of rickets (Groups 1, 3, 5, 6, 8, 12) varied between 5.6 and 7.8 mg per cent. That of all the groups showing gross evidence of rickets (Groups 2, 4, 7, 9, 10) was between 3.7 and 2.5 mg per cent. Group 11 which failed to show gross evidence of rickets showed nevertheless a decrease of the phosphorus to 3.6 mg per cent.

*We are greatly indebted to Dr. Edward C. Vogt, Roentgenologist to the Infants and Children's Hospitals for his assistance in the taking and interpretation of the roentgenograms.

HISTOLOGIC EXAMINATION

The sections of the principal organs showed no evidence of any morbid processes

Sections of the knee joint including the lower end of the femur and the upper end of the tibia and of the costochondral junctions were sub-

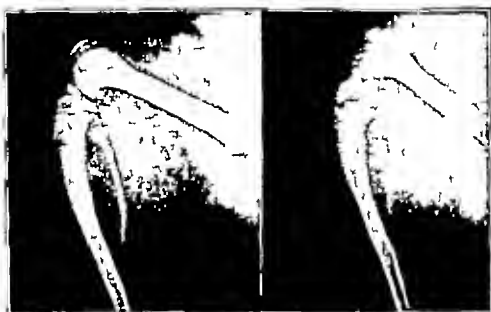


Fig. 5—Roentgenograms of lower extremity. Left Control no rickets. Right Steenbock diet advanced active rickets.



Fig. 6—Roentgenograms of lower extremity. Left Ferrous chloride diet, advanced active rickets. Right Iron ammonium citrate diet advanced active rickets.

mitted to Dr Sidney Farber* for examination without any indication as to their source. His report summarized in Column 8 of Table II, corroborates the findings in the roentgenograms. Severe active rickets was present in Groups 4 and 7 (Steenbock rachitogenic diet), Group 2 (ferrie chlorido diet), Group 9 (ferrie ammonium citrate diet), and

*We appreciate the cooperation of Dr Sidney Farber, Pathologist to the Infants and Children's Hospitals, in reviewing the pathologic sections.

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*We are greatly indebted to Dr. Edward C. Vogt, Roentgenologist to the Infants and Children's Hospitals, for his assistance in the taking and interpretation of the roentgenograms.

In 1931, Branion, Guyatt and Kay⁸ reported briefly the production of bone lesions similar to rickets in young rats by the replacement of the calcium carbonate in Steenbock's rachitogenic diet No. 2965 with an equivalent amount of beryllium carbonate. They have expanded these observations more recently (1933) and have shown that the administration of cod liver oil, vitamin D or ultraviolet light in generous amounts does not prevent the onset of this type of rickets.⁹ They mention that sections of the bones of their animals show striking differences from the appearances usually encountered in low phosphorus rickets.

Cox, Dodds et al.¹⁰ in an excellent, brief report have shown that the addition of ferric or soluble aluminum salts to the diet of guinea pigs and rabbits interferes with the absorption of phosphorus from the intestinal tract, and claim that this effect is produced by the precipitation of phosphorus in the intestinal tract as ferric and aluminum phosphates.

Waltner, in 1927, published in the German literature evidence that reduced iron added to a nonrachitogenic diet produced rachitic like changes in rats.

In the investigations described in this paper, it has been established that the addition of large amounts of ferric chloride to a nonrachitogenic diet can render that diet rachitogenic to rats. The chlorine radical of the ferric chloride has been eliminated as the rachitogenic agent by the use of a control diet containing the same weight of chlorine in the form of ammonium chloride. It has been shown that this ferric chloride rickets can be prevented by the addition of excess phosphate sufficient theoretically to combine with all the ferric chloride as ferric phosphate. Ferrous chloride and ferric ammonium citrate have been shown to produce the same degree of rickets when added to the control diet in amounts equal in metallic iron content to the ferric chloride used in the ferric chloride diet. Partial evidence has been adduced that reduced iron behaves in the same way.

The rickets produced by the addition to the control diet of the aforementioned amounts of iron was in these experiments indistinguishable by roentgenogram, by chemical studies and by microscopic examination of the tissues from the rickets produced by Steenbock's rachitogenic diet No. 2965.

With these facts established it is interesting to speculate briefly as to the mechanism of the production of 'iron rickets.' The experiments were based on the assumption that iron might enter into chemical combination in the intestinal tract with phosphorus, to form compounds which are relatively difficult for absorption. There is considerable support in the results for the view that this actually happens.

The serum phosphorus was low in all the members of the rachitic groups. The fact that the ammonium chloride diet gave negative results eliminates the possibility that the addition of ferric chloride produces

SUMMARY

1 Rickets has been produced in rats by the addition of ferric chloride to a normal, nonrachitogenic diet.

2 The rickets so produced, as judged by roentgenograms, by microscopic studies, and by chemical studies, was qualitatively similar to, but more severe than that produced by Steenbock's rachitogenic diet No 2965

3 The addition of phosphorus to this ferric chloride diet prevented the occurrence of rickets

4 The chlorine radical of the ferric chloride has been eliminated as the rachitogenic factor by negative results from the addition of ammonium chloride to the nonrachitogenic diet.

5 Similar rachitic changes have been produced by the addition of other iron compounds to the nonrachitogenic diet.

6 The experimental and clinical significance of these findings has been discussed

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A COMPARISON OF THE NUTRITIONAL AND GROWTH VALUES OF CERTAIN INFANT FOODS

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AND

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NEW ORLEANS, LA

RECENT interest in infant feeding has been centered principally about the use of unsweetened evaporated milk as an infant food. It was only a few years ago that most of the authorities on infant nutrition looked upon the use of the various varieties of canned milk with askance, and it was not until 1929, when the experimental work of Marriott and Schoenthal¹ was published in regard to the merits of evaporated milk in the feeding of infants, that this prejudice was removed to any considerable extent. Later investigators have raised but few dissenting voices. It is almost unbelievable that medical opinion on such an important matter could be so completely reversed in such a short time, particularly in the absence of any great amount of well-planned and carefully controlled experimental work among infants.

The conviction is still prevalent in the minds of many physicians that fresh cow's milk is the infant food of choice where breast milk is not available. On account of this contention and also because of the stringent need for cheaper infant foods, we have attempted to evaluate the nutritional and growth values of three of the more commonly employed formulas, using breast milk as a control, viz (a) certified milk and milk sugar, (b) evaporated milk and milk sugar, and (c) Marriott's² lactic acid evaporated milk and Karo mixture.

Ample opportunity for such study of bottle-fed infants was afforded in the Memorial Mercy Home, New Orleans, where a large number of infants are born annually, many of them remaining in the institution throughout the first six or eight months of life. For the breast-fed, or control, group we elected to use the breast-fed infants attending two of the child welfare clinics in New Orleans.

METHOD

Sixty bottle-fed infants and twenty breast-fed infants were observed from birth through the first six months of life, the period of study extending from May, 1931, to January, 1933.

The bottle-fed infants were divided into three groups of twenty infants to a group, and each group was given one of the three formulas

¹From the Pediatric Service, Memorial Mercy Home, New Orleans and the Department of Bio-chemistry, Tulane University School of Medicine.

²Financial aid to this experiment was given by the Evaporated Milk Association.

described below throughout the period of observation. These infants were strictly institutional cases, in the Memorial Mercy Home where from fifty to sixty babies were cared for daily through routine methods. No attempt was made at selection, except that those cases were utilized whose expected stay in the institution would extend through the first six months of life. In a few instances cases were rejected on account of congenital defects, which, we felt, might have caused misleading results. The formulas were numbered 1, "2," and 3," and the infants were assigned chronologically in sequence of birth. We thus avoided the inclination to give any infant a particular formula, our aim was to eliminate from the experiment any patient that could not progress satisfactorily on the formula assigned in this way.

The control, or breast fed group, represents the first twenty infants successfully breast fed over a period of six months while attending two of the child welfare clinics in New Orleans. These infants of the poorer class private home were brought to the clinics every two weeks for supervisory care. The mothers were instructed in the principles of general care on their visits to the clinics and such instruction was augmented by frequent follow up visits to the homes by trained nurses. It is believed that in this way instructions were carried out completely in the majority of instances.

In the beginning we attempted to feed the lactic acid evaporated milk and Karo formula as suggested by Marriott, but on account of vomiting and diarrhea among the infants one or two months of age we were forced to abandon it. We found that by diluting this formula one third by volume with sterile water such difficulties were obviated. Such dilution gives a mixture which represents approximately 20 calories per ounce, 8.7 per cent carbohydrate, 2 per cent protein and 2.7 per cent fat. In order to harmonize the food concentration in the three different formulas and to maintain as nearly as possible in all three mixtures similar ratios between the carbohydrate, protein, and fat the other two formulas were constructed so as to conform in these respects quite closely with the diluted lactic acid evaporated milk and Karo formula described above.

The bottle fed infants were fed on the assumption that the age in months plus two equals approximately the stomach capacity of the child. The majority consumed less than this amount of food every three hours, six feedings daily. Most of the infants made satisfactory progress on 45 calories per pound of body weight in 24 hours while a few of them required from 50 to 55 calories. No increase in the concentration of the formulas was made with the increase of age, but formulas of the same strength were used throughout the experiment. As long as the weekly gain in weight was satisfactory for the age of the child no increase in the food intake was made.

TABLE I

SYNOPSIS OF COMPOSITION AND PREPARATION OF FORMULAS

Formula No 1		
Certified milk, boiled for 3 minutes	500 00 c c	Equals approximately 19 calories per ounce, 8.5 per cent carbohydrate, 1.7 per cent protein, and 2 per cent fat
Milk sugar	70 00 gm	
Lime water	60 00 c c	
Boiled water, enough to make	1,000 00 c c	
Formula No 2		
Evaporated milk	250 c c	Equals approximately 19 calories per ounce, 8.5 per cent carbohydrate, 1.7 per cent protein, and 2 per cent fat
Milk sugar	70 00 gm	
Boiled water, enough to make	1,000 00 c c.	
Formula No 3		
Corn syrup	90 00 gm	
Lactic Acid (U S P)	5 00 c c	
Boiled water, enough to make	500 00 c c	
The above acid sugar solution was added to 500 00 c c of evaporated milk and the resulting mixture diluted with 333 00 c c. sterile water. This equals approximately 20 calories per ounce, 8.7 per cent carbohydrate, 2 per cent protein, and 2.7 per cent fat		

All infants were given sun baths outdoors routinely when the weather permitted. It should be stated in this connection, however, that this phase of the general care of the bottle-fed infants was inadequate because the necessary facilities were not available, except on warm days when the cribs could be taken outside on open porches. This attention to the breast-fed, or control, group was carried out more fully, since these infants were in private homes where individual attention was possible.

Both breast- and bottle-fed infants received a standard brand of 10-D cod liver oil in the following amounts: from the second week to the first month 20 minims, three times a day, from the first to the third month 40 minims, three times a day, and from the third to the sixth month 60 minims, three times a day. Also orange juice was given to all infants as follows: from the second week to the first month 15 minims, twice a day, from the first to the second month 30 minims, twice a day, from the second to the third month 60 minims, twice a day, and from the third to the sixth month one-half ounce, twice a day. Cereal gruel was added to the diets at five months, and strained vegetable broth and cooked cereal were added at the sixth month.

Clinical records, kept on each case separately, included bimonthly physical examinations, semiweekly weight records on the bottle-fed infants and biweekly weight records on the breast-fed infants, nutritional defects with particular reference to rickets, the number and kind of infections, the presence or absence of gastrointestinal upsets, the state of nutrition, general condition, and physical attainments of each child.

At the end of the third and at the end of the sixth month of life, roentgenograms were made of the bones of both upper and lower extremities of all infants. The calcium and inorganic phosphorus content of the

blood serum was determined at the end of the third month and, in most cases, at the end of the sixth month in the bottle fed infants. The breast fed infants were excluded from the serologic determinations, because of objection on the part of parents to sinus puncture. The blood was collected by puncture of the longitudinal sinus, and the determinations were made shortly afterward. The method employed for the determination of calcium was that described by Clark and Collip² while the inorganic phosphorus was determined by the method of Fiske and Subbarow⁴.

Clinical rickets was diagnosed mainly on the basis of three signs viz (a) enlargement of the epiphyses (b) heading of the ribs at the costo-

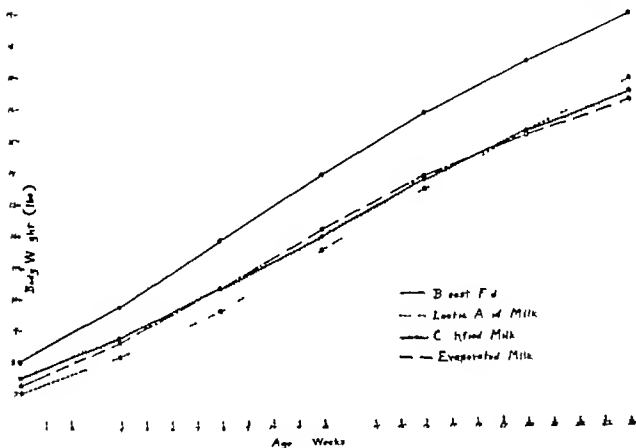


Chart I

chondral junctions, and (c) anemia and flabbiness of muscles. Other signs, such as head sweating, constipation abdominal enlargement, and cranial bosses, were taken into account and recorded. The radiologists (Drs E C Samuel and E R Bowie) reported their findings in the case of rickets as "negative," mild, 'moderate' or 'severe,' depending upon the degree of bone changes noted.

Weight curves have been plotted to show the average birth weight of each group as well as the average monthly gain in weight for each group. Table I gives a synopsis of the preparation and composition of the three formulas employed and Table II shows the average birth length and birth weight of each group and the average monthly gain in length and weight during the period of study.

RESULTS

Referring to the weight curves, it will be noted that the control, or breast-fed group of infants, made a much more rapid gain in weight than did any of the bottle-fed groups although the bottle-fed infants exceeded the normal expected gain in weight by the sixth month. Further it will be noted that the progress in growth of the breast-fed infants was more uniform and was not broken by the number of interruptions that were present among the bottle-fed infants.

The breast-fed infants were more vigorous, showed better tissue turgor, better osseous and muscular development, and were strikingly superior to the bottle-fed infants in physical attainments, such as the time of holding the head erect, the time of sitting up and the time of teething. By consulting Table II, which gives the average length and weight of the breast- and bottle-fed infants from birth to the sixth month, it will be noted that the average length of the bottle fed infants nearly equals that of the breast-fed infants while the average weight of the breast-fed infants exceeds that of the bottle-fed infants by almost three pounds at the sixth month.

TABLE II
AVERAGE LENGTH AND WEIGHT OF INFANTS FROM BIRTH THROUGH THE SIXTH MONTH

BREAST FED GROUP—20 INFANTS		
AGE	LENGTH	WEIGHT
Birth	20.0 inches	8.0 pounds
1 month	21.9 inches	9.7 pounds
2 months	23.6 inches	11.8 pounds
3 months	25.0 inches	13.9 pounds
4 months	26.5 inches	15.8 pounds
5 months	27.4 inches	17.5 pounds
6 months	28.0 inches	18.9 pounds
BOTTLE FED GROUPS—60 INFANTS		
AGE	LENGTH	WEIGHT
Birth	19.8 inches	7.25 pounds
1 month	21.7 inches	8.4 pounds
2 months	23.3 inches	10.5 pounds
3 months	24.7 inches	11.9 pounds
4 months	26.1 inches	13.7 pounds
5 months	26.7 inches	15.2 pounds
6 months	27.7 inches	16.5 pounds

At almost any time during the period of study, as many as one or two infants could be found in any one of the bottle-fed groups, who for one reason or another were not making satisfactory progress, but on the whole, the nutrition and growth of these infants remained quite good. Diligent attention to diet was necessary in order to maintain uniform progress among the bottle-fed infants, and this was particularly true of the group fed on boiled certified milk and milk sugar, primarily because of indigestion and constipation among the members of this group.

The three different formulas employed gave so nearly the same results in growth and nutrition that it is not considered worth while to attempt any contrast of the slight differences, and we shall consider it sufficient simply to call attention to the weight curves of the bottle-fed infants and to state that as a whole the group fed on the dilute lactic acid evaporated milk and Karo formula excelled the other two bottle fed groups somewhat in quality of nutrition.

Clinical diagnosis of rickets was made in 35 per cent of the breast fed infants and in 85 per cent of the bottle-fed infants, the radiologists reporting the disease in 90 per cent of the bottle fed infants and in 35 per cent of the breast fed infants. There was no difference in the incidence of rickets among the infants receiving the three different formulas. Severe rickets was present in only a few cases of the bottle fed infants, the breast fed infants and the vast majority of the bottle-fed infants presenting the condition in mild or moderate form. There was no case of scurvy or tetany observed or any obvious evidence of lack of the accessory food factors in the diets.

The average calcium level of the blood serum of the three bottle fed groups was 10.41 mgm. per cent at the third month and 10.36 mgm. per cent at the sixth month, while the average level of the inorganic phosphorus of the blood of these infants was 5.65 mgm. per cent at the third month and 4.87 mgm. per cent at the sixth month. It will be seen from these figures that the average calcium phosphorus product was 51.81 (10.41×5.65) at the third month and 50.45 (10.36×4.87) at the sixth month, notwithstanding the facts that 85 per cent of these infants had rickets according to clinical evidence and that the radiologists reported the disease in 90 per cent of the bottle-fed series.

The usual types of infection were encountered in both the breast and bottle fed groups such as the acute upper respiratory infections, acute bronchitis, tonsillitis, acute otitis media, impetigo, pyclitis, pneumonia, and generalized furunculosis. Particularly acute otitis media, impetigo and generalized furunculosis were more prevalent among the bottle fed members, but there did not seem to be any difference in susceptibility to infection among the infants of the different bottle-fed groups.

Although nearly all of the breast fed infants had frequent attacks of colic during the first two or three months of life such disturbance rarely retarded the progress of the child. These attacks were characterized by marked fretfulness, abdominal distention and greenish colored stools that were strongly acid in reaction and contained large amounts of mucus and curds. There was considerable rumination shortly after feedings at times actual vomiting, and in a few instances such attacks terminated in fermentative diarrhea. After the third month the breast fed infants rarely showed any digestive disturbance, except in the occasional case, where over feeding was usually at fault. Constipation was seldom met with among the breast fed infants, their stools being of bright

yellow color, of almost liquid consistency, of a slightly sour odor, and acid in reaction. Except in cases of indigestion, or colic, the stools were smooth and contained no mucus or curds.

The group of infants fed on boiled certified milk and milk sugar had frequent gastrointestinal upsets, with symptoms that often called for temporary change of diet. These upsets were more frequent during the early months of life, but they also occurred quite often throughout the period of observation, definitely placing this group of infants first in rank in the number of feeding difficulties encountered among the bottle-fed groups. Stubborn constipation was quite prevalent among these infants and was apparently the forerunner of many of their gastrointestinal upsets. We were forced to administer milk of magnesia almost daily in order to overcome the constipation. These infants did not handle the boiled certified milk with the same ease of digestion that was apparent among the other two groups fed on the evaporated milk formulas. Their stools were of light yellow color, from semisolid to firm in consistency, alkaline in reaction, and often contained large curds, mucus, and other evidence of undigested food. In three instances patients were dropped from the experiment on account of their inability to handle the formula assigned them, two of them having had boiled certified milk and milk sugar and the other evaporated milk and milk sugar.

The group of infants fed on evaporated milk and milk sugar showed better digestion and, consequently, fewer gastrointestinal upsets than did the group fed on boiled certified milk and milk sugar. There was, however, an appreciable difference in the facility with which this formula was handled as compared to the dilute lactic acid evaporated milk and Kao formula, the latter being much more readily digested. The stools of this group of infants were of light yellow color, semisolid in consistency, alkaline in reaction, and did not often show evidence of undigested food.

The group of infants fed on the dilute lactic acid evaporated milk and Kao formula rarely showed any signs of indigestion and had fewer gastrointestinal upsets than any group of infants observed. They were easily managed from the standpoint of diet, their appetites being consistently better than for either of the other two bottle-fed groups. The tendency toward constipation was much less marked in this group of infants, their stools being of smooth pastylike consistency, grayish in color, and alkaline in reaction.

COMMENT

It would probably be unfair to assume that there is normally as great a difference in the growth and development between breast-fed infants and bottle-fed infants as our results would indicate. The parents of the control, or breast fed group, were nearly all of Italian or Irish extraction.

tion, of the large, robust type individual, many of the mothers having had five or more children previously, who had been successfully breast fed. After checking the diets of these mothers, it was found that most of them ate heartily and that their diets contained liberal amounts of fresh vegetables, fruits, milk, meat and eggs. They were hard working women, engaged in household duties who had little time in which to develop the neurotic chain of symptoms that often interfere with breast feeding. It was not our purpose to select this particular type of mother, but she seemed to be the predominating type among those coming to the clinics who could successfully nurse their infants without the aid of complemental or supplemental feedings. Then again, we have individual care in the private home in the case of the breast fed infants as against institutional environment and institutional care in the case of the bottle fed infants. The supply of breast milk in the majority of instances was plentiful, many of the mothers having sufficient amount to have nursed two healthy infants. We believe that the sum total of these factors would bring the control or breast fed group of this experiment, well beyond what is ordinarily considered good conditions for breast feeding.

Considering the results we have obtained in growth and nutrition by use of the three formulas, it would be logical to presume that it makes little difference what milk is used so long as the diet is balanced in the essential food constituents is adequate in amount, is within the digestive capacity of the child and contains the necessary vitamins. There is no doubt that evaporated milk is more easily digested than fresh cow's milk, regardless of upon what the crux of the explanation of this fact may depend. The ease with which a food is digested and the presence or absence of the aggravating symptoms of indigestion are important matters in the feeding of infants. It was due to these difficulties that we found the group of infants fed on the boiled certified milk and milk sugar so troublesome to feed. Feeding difficulties are not always reflected in the end results obtained in nutrition and growth. Our control group of breast fed infants nearly all had digestive difficulties during the first two or three months of life as well as the group fed on boiled certified milk and milk sugar and both of these groups made good progress in nutrition and growth at all times during the period of observation.

It appears in this experiment from the parallel feeding of the different groups of infants on fresh cow's milk and evaporated milk formulas, that the difference in the digestibility of these two forms of milk depends largely upon the difference in curd tension. The changed state of the milk protein brought about by the superheating of evaporated milk as well as its homogeneity are perhaps characters of decided importance. Rice⁵ demonstrated the soft curd of evaporated milk, and later Brenne mann⁶ emphasized its practical application to infant feeding. The work of Willard and Blunt⁷ on the retention of calcium, phosphorus, and nitrogen, by infants fed on pasteurized milk and on evaporated milk

would seem to indicate that more of these elements are retained in the blood when evaporated milk is used. Our results do not substantiate these findings, so far as the retention of calcium and phosphorus are concerned.

We are not convinced that young infants may be fed whole milk to good advantage, whether acidified or not. One of us (Williams) has endeavored on other occasions to feed young infants the lactic acid evaporated milk and Karo formula suggested by Marriott, but has consistently met with the same results, vomiting and diarrhea. It had been thought that these difficulties might be due in part to the warm climate in this section of country, but we note that other writers north of us⁸ have recently reported similar findings. We concur in the almost unanimous opinion that the addition of lactic acid to milk renders it more digestible and increases the safety level to which carbohydrate may be added to the formula, but it is obvious that the degree of this improvement is yet undetermined, as evidenced by our inability to feed the concentrated whole milk mixtures to young infants. We consider the lactic acid evaporated milk and Karo formula more or less ideal for the routine feeding of infants, provided the concentration is kept within the digestive limits of the child to be fed. It is particularly well adapted to the feeding of institutional infants, due to the fact that it is readily prepared, easily fed, and is utilized well by the vast majority of infants. In fact, our results have been so uniformly satisfactory from the use of this formula that it has been adopted as the standard feeding mixture in the Memorial Mercy Home, but modified for the first three months of life as described under "Method." After the first three months, we now feed the whole lactic acid evaporated milk and Karo formula as suggested by Marriott.

As a result of past experience in attempting to feed whole lactic acid milk to young infants and of former teachings with reference to the use of canned milk in general, this experiment was begun with considerable prejudice against the routine feeding of lactic acid milk and with certain reservations that were derogatory to the use of evaporated milk. This study was instituted primarily to settle these questions in our own minds so that we might proceed with greater assurance and with prejudice or doubt dispelled. At the conclusion of this work, after feeding groups of infants of the same age and under the same environment on fresh cow's milk and on evaporated milk with almost identical results in nutrition and growth, our attitude has naturally been materially changed. We no longer frown on the use of evaporated milk as an infant food, but we believe that it is just as good as certified milk, with these added points in its favor: it is more easily digested, consequently, causes fewer gastrointestinal disorders, there is less danger in its use where refrigeration is in question, it is produced under national government regulations, which circumvents petty politics so often met with in various cities prohibiting

the passage of the proper milk ordinances it facilitates the preparation of formulas and is much cheaper

Considering the number of infants of this study who had rickets it would seem that the incidence of the disease is unusually high, although DeBuys and von Mevsenburg⁸ reported 34 per cent of breast fed infants as having rickets in this locality in 1924. Attention should be called to the close check between the clinical and roentgenologic evidence in arriving at a diagnosis of rickets among these infants and to the comparatively worthless application of the calcium phosphorus product criterion. Either the standard of 40 as the normal product is low or else these elements exist in the blood of rachitic infants in a changed state from that of the normal infant. The average calcium and phosphorus products were well above 40, both at the third and at the sixth months of life yet 85 per cent of the infants under observation showed rickets.

SUMMARY

Sixty infants were divided into three groups of twenty and each group was fed one of three different formulas from birth through the sixth month the results obtained in nutrition and growth being compared to corresponding results obtained by feeding twenty infants on breast milk over a similar period of time.

Each individual was closely checked for quality of nutrition, growth and development, nutritional diseases digestive disorders and for the number and types of infection.

At the end of the third and of the sixth months of life roentgenograms were made of the bones of the upper and lower extremities on all cases and at these same intervals the serum calcium and inorganic phosphorus were determined on the bottle-fed infants.

Curves have been plotted to show the average birth weight as well as the average monthly gain in weight of each group from birth through the sixth month. Table I gives a synopsis of the preparation and composition of the formulas used while Table II shows the average birth length and birth weight of the various groups and the average monthly gain in these factors from birth to the end of the sixth month.

Effort has been made to compare the results obtained by feeding the three different types of formulas and to give some reasons for the conclusions as to which is best adapted to the general routine feeding of infants.

CONCLUSIONS

The results in nutrition and growth obtained by feeding fresh cow's milk and evaporated milk formulas were almost identical. Evaporated milk being more easily digested than fresh cow's milk, caused fewer gastrointestinal upsets and was less difficult to feed.

The addition of lactic acid to milk renders it more digestible and increases the safety level to which sugar may be added to the formula. The lactic acid evaporated milk and Kao formula suggested by Marriott was poorly tolerated by infants under three months of age, but when diluted one-third by volume with sterile water, these difficulties were obviated. This formula was more easily digested and was easier to feed than either the fresh cow's milk formula or the evaporated milk formula, it gave excellent results in growth and nutrition and is recommended for the general routine feeding of infants less than three months of age.

The incidence of rickets among the infants of this study was high, particularly so, since all of them received rather large amounts of cod liver oil routinely, as well as sunshine outdoors. There was no difference in the incidence of rickets or in the frequency of infections among the members of the different bottle fed groups.

The clinical and x-ray findings in the case of rickets checked quite closely while the serologic evidence was entirely out of line with the usual accepted standards.

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3439 PRYTANIA STREET

ON THE MOTION OF GROWTH

XVI. CLINICAL ASPECTS OF HUMAN GROWTH AND METABOLISM WITH SPECIAL REFERENCE TO INFANCY AND PRESCHOOL LIFE

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INTRODUCTION

CLINICAL interest in human growth is centered upon three principal phases of the problem. The first is clearly concerned with the events of growth itself as these are displayed by data collected in the mass or from observations upon individual subjects, which define the age trend of changing size in presumably healthy infants or children. The second relates to the highly important matters of nutrition but more specifically to the success or to the failure of various nutritive substances in promoting and in supporting the processes of growth. The third phase equally distinctive in its primary objects, though it is unmistakably linked with each of the former deals with the phenomena of energy exchange as judged especially by the production and liberation of heat.

Taken together these three phases are intimately related to the general problem of income, balance, and outgo of energy. Each has been thoroughly and widely examined in the laboratory, as well as in the clinic and the chief results have found extensive application in the routine care of infants and children. But in the absence of some single unifying principle much of this information has been treated as discrete or, when considered to be related, it has been treated only vaguely so. A fresh outlook, however upon the many collateral problems in these three fields, as well as a clearer understanding of them ought now to be assured by the dynamic connection which we have been able to establish between the events of pure growth on the one hand and those of heat production or "metabolism" on the other.¹ Certain introductory features pertaining to the clinical side of the subject have already been described.² Among other things we have placed special emphasis upon such basic matters as the definition of growth, the careful distinction between true growth and ordinary gain, the broad underlying scheme of energy exchange and the differentiation between basal heat output and maintenance rate of heat production.

With these results in mind we shall now work forward to a discussion of various problems of growth and metabolism which possess noteworthy clinical importance, restricting our selection of these to such as arise

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during infancy and preschool life. We shall prepare, in particular, to consider one of the handicaps to growth which makes the rearing of premature infants a difficult task, the accidental character of the loss in weight at birth, the rate of gain during infancy, and finally, in describing the metabolism of the preschool child, to offer a new interpretation as to the physiologic background of anorexia so frequent at this stage of life. Similar problems of adolescence such as "spurts of growth" and "spurts of metabolism" will be deferred to a later time.

To accomplish these purposes it will be necessary to investigate quite intimately the life trends of both growth and basal heat production throughout the entire span of infancy and childhood. The first step in this direction is to establish the units in which each of the latter is most suitably measured.

Preliminary Survey of Items Essential to the Study of Growth and Metabolism

To begin with, we shall find it useful, as previously indicated, to consider the matters of growth hand in hand with those of heat production or "metabolism." In fact, a complete analysis of growth requires such treatment, for the nature of this process cannot be properly understood by detailing merely successive changes in size. The traditional method of portraying and of studying "growth" almost exclusively in terms of items (1) and (2) in Table I suffices, it is true, for some clinical purposes. But it is necessary, if satisfactory information on the subject is desired, to deal with each of the other equally important items in this table. For this reason, though even more because of the extreme importance of distinguishing clearly between "cumulative gain" (item 1) and "true growth" (item 4), and hence, between rate of gain (item 2) and rate of growth (item 5), we shall enlarge upon the characteristic differences which are but briefly presented here. Special attention will therefore be directed to the life trends of these four components in addition to the corresponding trends exhibited by items (7) and (8). The latter, as we have elsewhere shown,¹ are not only intimately related to, but are actually dependent upon several of the functions listed under "growth," the chief of which is item (5) and its square

LIFE TRENDS OF GROWTH AND METABOLISM

Curves of Weight and Rate of Gain (Fig 1, z and z')

Because of its familiarity we shall speak of "growth" primarily in terms of weight, and shall consider at the outset the cumulative changes in weight that are, on the whole, characteristic of healthy subjects over the entire, or almost entire life cycle. The description is best followed by keeping in mind and by comparing the simultaneous changes in both

weight and rate of gain throughout the entire epoch of "growth" as given by the respective curves z and z' in Fig 1 which embody the results of an analysis originally reported as our Series XIX¹. The prenatal phase, too minute on this chart to be of use on account of scale, is drawn in

TABLE I

A LIST OF ITEMS ESSENTIAL TO THE STUDY OF GROWTH AND METABOLISM AND THEIR CORRESPONDING PRACTICAL UNITS OF MEASURE

ITEM FOR STUDY	SYM BOL	PRACTICAL UNIT	
Growth			
1. Cumulative Increments of Size†		Gm †	kg
2. {Rate of Change in Size (Rate of Gain)}‡	z'	Gm /Day	Kg /year
3. Acceleration of Gain	z''	Gm./Day/Day	Kg /year/year
4. Cumulative Increments of Growth (Change in Size per Unit Size— <i>True Growth</i>)	q	Gm./Kg	Kg /Kg
5. {Rate of Growth}‡	q'	Gm /Kg /Day	Kg /kg /Year
6. Acceleration of Growth	q''	Gm /Kg./Day/Day	Kg./kg./year/year
Metabolism † (Basal State)			
7. Quantity of Heat Produced per Day	(Ue)	Cal./Day	
8. Quantity of Heat Produced per Unit of Size (Weight) per Day (<i>True Basal Metabolism</i>)	U	Cal /Kg /Day	

A more complete description of the above as well as of other quantities important to growth and metabolism has been given in a recent paper. Of special significance are the fundamental properties of growth described as resistance p , inductance λ , and permittance z , which enter into the scheme of energy distribution and thereby act in conjunction with the above items to assist in defining the successive changes of state throughout growth.¹

†These, when plotted, form what is customarily though incorrectly referred to as "the growth curve."

‡This and the succeeding quantities employing the gm. as the unit of mass are chiefly used for measurements of weight during infancy, the day as the unit of time, being likewise customary during the same period.

§The square of items (2) and (5) that is (rate of gain) and (rate of growth) respectively in addition to various products of the above components of growth, also require to be enumerated here.

¶The term "relative rate of growth" has been habitually used as synonymous with "relative rate of gain." But it will be evident that the former of these can have no real meaning as long as we accept the present definition of growth to be broadly "a change in size per unit size," wherein the "relativity" of growth is already provided for and explicitly stated. There are several ways in which the foregoing important distinctions may be further clarified. Assume, for example, that the term "relative rate of growth," just now under suspicion, is provisionally equivalent to what is actually represented by the relative rate of gain and is measured in Kg/Kg/Day. This would mean obviously that "growth" and gain are synonymous as indeed they have been considered to be in times past. Such a result, however, is clearly in conflict with the definition that growth is "change in size per unit size" which we have found indispensable to a dynamic study of the problem.¹ The distinctions, moreover, which have heretofore been necessarily made by means of the terms "relative" and "absolute" in connection with rate of change, are now automatically contained in the terms "growth" and "gain" respectively whence on the present basis the expression "relative rate of growth" is precisely equivalent by substitution to "relative-relative rate of gain." From this it is at once obvious that the former (i.e. "relative rate of growth") can have no significant meaning. There will, accordingly, be no need of distinguishing between "relative" and "absolute" growth or gain, for growth and gain are both "absolute" entities as here conceived and defined. From what has just been said, the connection between growth and gain is best expressed and remembered in the form "Rate of Growth = Relative Rate of Gain (or Loss) either of which is therefore synonymous with "Rate of Reduplication" provided the latter is understood and permitted to assume both fractional and integral values.

¶The large or Kg. calorie.

semilogarithmic fashion to a greatly enlarged scale in Fig 2, the resulting curve thus automatically displaying the corresponding trend of item (4) and requiring a change of symbol from z to q^* . These curves together portray the trend of weight from the one-hundredth day of gestation in fetal life to the thirty second year of postnatal existence

The chief characteristics of "growth in weight" are thus seen to group themselves about the two major deflections in the curve describing the rate of gain, z' . The former holds sway over the circumnatal epoch which includes the late fetal, or premature, natal, and infantile periods

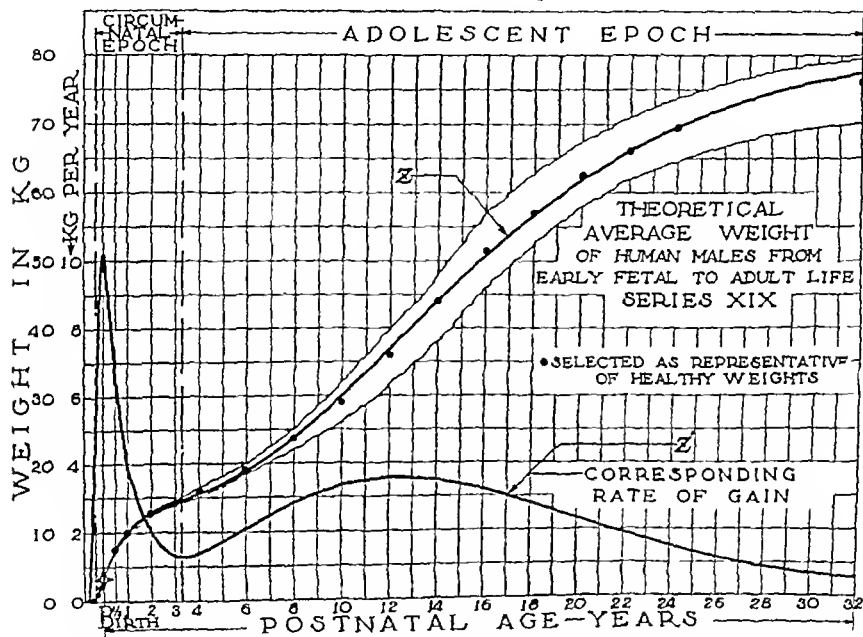


Fig 1—Theoretical curves of weight (z) and rate of gain (z') from early fetal to adult life. The boundaries of the white field through which z passes mark what may be considered the ordinary upper and lower limits of weight in healthy children as expressed in the data of a large group of investigators.¹⁻³

*It is worth noting here especially in connection with the discussion regarding the important distinction between *growth* and *gain* that curves drawn on semi-logarithmic grids such as that for the fetal epoch in Fig 2 actually display the trend of 'true growth' and are therefore properly growth or ' q ' curves (Table I) whereas those drawn on ordinary arithmetic grids such as z in Fig 1 represent simply the trend of cumulative increments in size. (See footnotes to Table I for additional comment on this point)

A more serious error however arises when figure legends to curves for cumulative weight, z (Item 1 Table I) are made rather frequently to read showing the rate of growth. It is true, of course, that the changing slope of such curves as for example z in Fig 1 is a measure of the rate of change in size (rate of gain) and that we may infer the result by noting the variations in slope from point to point but they do not themselves represent the rate of change because this can be directly exhibited only by some corresponding curve such as z' (Item 2) in the same figure. By the definitions in Table I it is clear moreover that neither z nor z' is properly speaking a growth curve for according to item (4) the specific features in the trend of true growth cannot be graphically presented except by drawing z on semi-logarithmic paper or what is actually the same thing by plotting logarithms of the weight on an ordinary cross-section grid. The rate of growth q is then given by the corresponding velocity curve of the latter just as illustrated in Fig 3

†Davenport⁴ has also employed the terms circumnatal and adolescent, though in connection with and as referring to cycles the former beginning at fertilization and ending between two and three years postnatal age, the latter however not setting

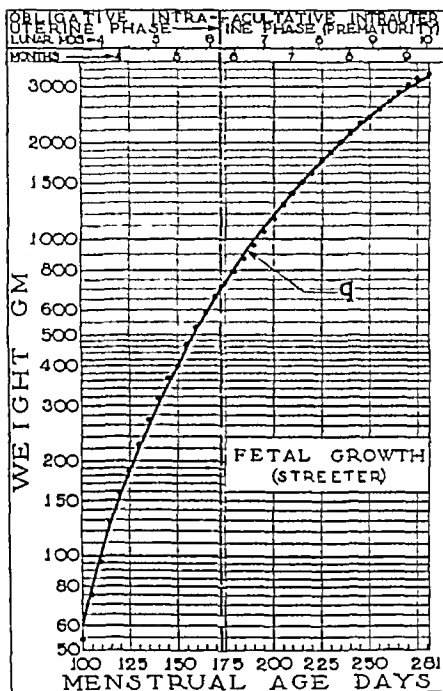


Fig. 2.—The curve for fetal growth from the one hundredth day of menstrual age to birth. The solid circles represent the mean values of every fifth day in the original data of Streeter.¹⁰ The line of demarcation is drawn, somewhat arbitrarily, to pass through the value 700 gm., the intersection thus occurring at the 173rd day menstrual time.

In until ten years and lasting until the twentieth year. From the clinical point of view it seems better, however, to date the onset of the circumnatal epoch at the time when the possibility of extrauterine existence is first assured. This is approximately, at the point where the fetus has reached about 60 gm. and hence at about the 173rd day of gestation by menstrual time. Smaller "prematures" have been born and have even thrived (600 gm.) though it is not to be expected that all could necessarily do so much before they had reached considerably greater weights. Neglecting for the moment this difference in the location of boundaries it may be noted that we prefer to avoid the term "cycle," introduced by Robertson and used since by writers on growth to designate an interval during which the rate of gain rises from, and returns to, its previous low level, because such a period, properly speaking, represents only a half cycle. If nevertheless, we wished to abide by this custom, and desired, in addition, to place the outer boundary of the circumnatal "cycle" at 130 years (as we do) where \dot{x} has its minimum value 1.27 Kg per year it would be necessary to move the anterior boundary from the 173rd to the 103rd day of gestation where the value of \dot{x} is also 1.27 Kg. per year. Here, however, the fetus weighs but 60 gm. and has no physiologic chance of becoming a natal candidate. Returning once more to the matter of cycles, it may be remarked that the latter notation is primarily avoided in our own work because the curves for weight x and rate of gain \dot{x} in Fig. 1 are represented by compound exponential equations such that x and \dot{x} can only have the single imaginary period, $2\pi/\omega$ where $i = \sqrt{-1}$.

of life. Its peak is uncannily placed at the moment of normal birth itself, and this is followed by a swift decline throughout the first two years of life, when teeth are erupting, when the blood is changing, and when walking and talking are added to the accomplishments of the "little man." A period of comparative rest follows the impetuous epoch just passed through, as though to prepare for the longer, though less strenuous, period of adolescence ahead, which reaches its own peak, so far as the rate of change in weight is concerned, between the twelfth and thirteenth years. Thenceforth, "growth" (as judged by rate of gain) passes at last into the final stage of gentle decline, to come ultimately to rest when weight has reached its upper stationary value in adult life. These features are widely known, they are not new, but from them we shall try, in the light of results elsewhere reported, to reinterpret the events of "normal growth" as these relate to the care of healthy infants and children.

The trend of weight just described in connection with curve *z* of Fig 1 corresponds closely to that represented in the majority of data collected by a host of investigators.^{7, 28} This particular curve is, accordingly, much more similar to the curves derived on the basis of mass statistics than to those plotted from the successive weights of single subjects. The latter are disposed, as we must always expect, to be less regular than the former, and they show frequently what are of late referred to as "spurts of growth." These will receive attention when we come to discuss the clinical aspects of growth during the adolescent epoch, though it is well to point out here, that such spurts under normal conditions, are rarely if ever as prominent during the circumnatal period as they are at later stages of life. But, even though it must be frankly admitted that no child's weight will proceed strictly along the entire course of the curve here described, it may nevertheless be said that the weights of a healthy subject of European or American stock will almost invariably be found scattered somewhere within the field of Fig 1, which surrounds curve *z* itself. It is correspondingly unlikely that the weight of a healthy child will lie significantly beyond this range, though the weights of special groups, such as the California gifted of Baldwin,⁸ and the private school children of Gray and Ayres,¹⁷ will obviously tend toward the upper limit of this field, and even, as in the latter example just referred to, slightly but definitely beyond this boundary.

The trend of the field itself possesses the selfsame characteristics as the curve traversing it. This is not at all surprising since the data, from whatever source, have all been obtained from studies on "more or less" healthy human subjects. For certain purposes it is best to work with a "field" of growth such as that sketched out, any point included therein being justly considered, so far as our observations go, within the range of the healthy, or so called "normal average" weight at various ages. But, for other purposes, it is equally necessary to fix upon some single

curve passing through this infinitude of points, which then may be held to represent the normal trend in question. We have here deliberately chosen curve *z* of Fig 1 in part but only in part, because it represents effectively the general shape, level, and direction which the better data on the healthiest children quite clearly disclose. This particular curve has also been chosen to represent the trend of weight because it has been found, upon further analysis,¹ to possess the very components (especially Items 1, 2, and 5 of Table I) which permit its transformation, upon the basis of the scheme of energy exchange previously described,² directly into the corresponding curves for heat production shown in Fig 4. The former thus constitutes the "growth counterpart" of heat production and the latter, in turn, the "heat counterpart of growth." Such a result speaks greatly in favor of the opinion that the weight curve of Fig 1 is not far removed from what can be considered a legitimate physiologic "norm" of human growth. It provides, likewise, direct evidence that "growth" and "metabolism" are dynamically part and parcel of the same fundamental biologic process. From the theoretical point of view in particular but also to a great extent, even from the practical side, we are thus justified in placing decided confidence upon this, or for that matter, upon any other weight curve within the field, which, by means of its appropriate components, redescribes the full course of basal heat production. For such a curve is doubly anchored: it is "held" on the one side by the original data on weight and on the other by observations of a different kind which have even been made independently of weight itself.

Thus, so far as the clinical importance of weight alone is concerned, curve *z* in Fig 1 may be taken to represent with some considerable certainty the life trend of this particular unit of human size. No pediatrician will expect that all of his healthy subjects or even a single one of them will follow the curve exactly though he will also realize that no healthy child will deviate greatly from it. The failure of a child to pursue this particular trend of increase in weight will not prevent us, on the theoretical side, from conceiving such progress to be possible under an ideal set of conditions. The point just now in question is no doubt of greater analytical than clinical concern though it seems of sufficient current importance to be noted here and to be summed up as follows. The weights of healthy children will in general be somewhat above or below curve *z* of Fig 1 but they will also be distinctly in the neighborhood of this or of some other standard and the latter will likewise lie somewhere within certainly not far beyond the bounds sketched out.

*Curves of Growth and Rate of Growth (Fig 3, *q* and *q'*)*

Thus far we have viewed the problem of human "growth" in terms of cumulative increments in weight and in terms of the rate of gain. But,

in accordance with the definitions of Table I, neither of these trends can be said to represent the course of true growth correctly. In order, therefore, to distinguish clearly between ordinary gain and growth, as well as between their rates of change, we have brought all four curves together in Fig 3 with the hope of obtaining the sharpest possible contrasts.* The events and characteristics of true growth, q , and q' in the lower section may thus be simultaneously compared with those of z and z' placed above them. These comparisons are made with reference to weight and rate of gain partly because the latter are bound to be by far the more familiar, and partly too, because we habitually measure "growth" only in terms of simple change in size, and most conveniently in terms of weight itself. We do not, nor can we, measure growth q , directly. Arithmetical approximations to this are even likely to be very seriously in error and more accurate estimations require mathematical analysis too burdensome for ordinary clinical work. The latter remarks apply with still more force to the determination of the rate of growth.

Growth q Compared With Cumulative Weight z —Aside from easily recognized differences in the general contours of these two curves, the most perceptible difference is perhaps to be found in their relative levels at corresponding points of time. We cannot escape the definite impression that growth q , so far as nearing completion is concerned, keeps well in advance of weight z . This particular effect is most conspicuous during infancy and early childhood although it is likewise noticeable, even if in lesser degree, at later stages of life. Thus we find by actual computation that the quantity of growth q at birth has already reached approximately 25 per cent of its final value, whereas weight z lags far behind in having reached but 4 per cent of its own adult level. Comparing the same items at the end of the circumnatal epoch (3.30† years), we see that growth is 61.5 per cent and weight 18.3 per cent complete. At 16 years growth is 90 per cent achieved though weight is merely 64 per cent fulfilled. Beyond 16 growth is negligible indeed, though increase in weight continues normally until much later. These estimates in conjunction with the curves, show clearly that, for the period succeeding the obligative intrauterine stage of life (Fig 2) growth accumulates in greatest quantity during the circumnatal epoch. Under ordinary conditions we have the opportunity of observing this only during normal infancy, and the latter, accordingly, becomes the period of postnatal growth *par excellence* just as it is commonly held to be.

But, interestingly enough from the standpoint of the present discussion, we are apt in the routine course of events to think of infancy as the

*In reading this section devoted to the differentiation between growth q and weight z it will probably be helpful to recall in addition to the brief definitions of Table I that growth q explicitly takes account of the quantity of tissue which is responsible for generating the resulting change in size. If we remember moreover that rate of growth = rate of reduplication under the conditions stipulated in a footnote to Table I it is clear that quantity of growth must be equal to quantity of reduplication and hence, more generally, to change in size per unit size.

†The final 0 is significant, the correct value to three decimal places being 3.301

"grand" period of growth almost certainly from considerations of change in weight (Σ) rather than because of actual changes in growth itself although these as we now see are even more strikingly displayed

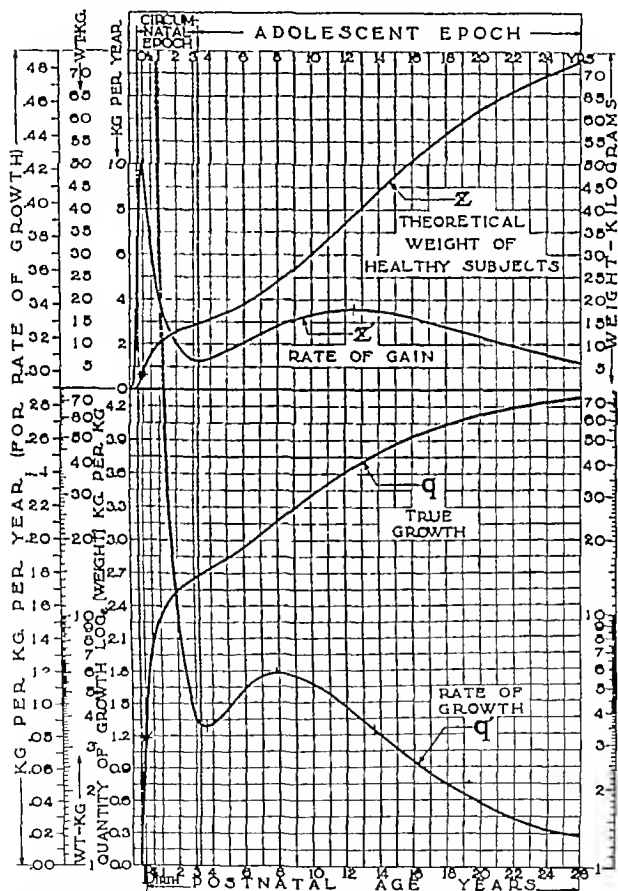


Fig. 3.—The curves of true growth q and rate of growth q' compared with Σ and Σ' . A thread or straight-edge leveled with the aid of the two logarithmic scales will enable the equivalent values for weight along q to be read at a glance. The scale for quantity of growth is divided with reference to 1 kg. at the start, that is at the 190th day or just 17 days beyond the line of demarcation in Fig. 2. If reference on the basis of 1 gm. be desired, it is necessary to add 5 9078 to all values on this scale.

Corresponding Curves of Heat Production
[Fig 4, (U_z) and U]

We shall study this equally important phase of the problem of growth and metabolism by means of curves (U_z) and U in Fig 4. The upper represents the trend of basal heat output in terms of Cal/Day , the lower in terms of $\text{Cal}/\text{Kg}/\text{Day}$. Each of these rises rapidly during the first year (in contrast to the equally steep descent of the curve representing the rate of gain) to reach a somewhat different type of peak at or just after the end of this first year. The curve for daily heat output (U_z) then descends unmistakably, though not greatly to a minimum located at about 3.30 years, the drop during this period being just less than a $100 \text{ Cal}/\text{Day}$. But the curve for heat production in terms of $\text{Cal}/\text{Kg}/\text{Day}$, U , descends to the boundary of the circumnatal epoch almost as sharply as it had previously risen to its peak, thenceforth continuing in a shoulderlike descent, (at an extremely low rate up to the age of six) whence it turns downward again into a more definite fall to approach closely to the "equilibrium" or maintenance level at about 24 years of age. The latter remains constant, or better perhaps, it is assumed from the dynamic side of the problem to remain so throughout life, the excess of heat output above this being entirely due, as we have elsewhere described in greater detail,² to the overload of growth itself.*

Each of the foregoing curves thus represents the trend of basal heat production in its own particular unit, Cal/Day and $\text{Cal}/\text{Kg}/\text{Day}$, respectively. Each may be, and has been taken, as an expression of the age change in "basal metabolism." But to do so indiscriminately will lead to confusion and even to serious error in clinical work. We meet, for example, with the statement that basal metabolism declines with age. This, obviously, could apply solely to the lower curve, U , representing heat production in $\text{Cal}/\text{Kg}/\text{Day}$ and then only for the period succeeding the first year. Yet sooner or later we encounter the declaration that energy requirements and heat output are proportional to weight (or to body surface, either real or effective), and we are therefore required to infer that "metabolism" increases with advancing years. Clearly, the

*More directly illustrated in Fig 5 where the area between the maintenance level and the curve for U in $\text{Cal}/\text{Kg}/\text{Day}$ represents the quantity of heat held to the account of growth. This portion is itself the sum of heat of dissipation and heat of cellular synthesis (proliferation) as previously described and vanishes when growth has ceased. The comparatively high metabolism of infants and children is therefore directly to be attributed to the fact that they are immersed in the flux of growth; in contradistinction to the quite unsatisfactory though traditional explanation invoking the surface law.

It has been interesting while preparing this paper to learn that Fleming³¹ expressed somewhat similar views a decade ago and he is so far as we are aware the only writer on the subject to have suggested unmistakably that the high metabolism of childhood may be due to growth itself. He undertook to demonstrate this by a method of computation equivalent to approximating the area between U and the maintenance level in Fig 5 and the results seem to afford, he says, a certain amount of evidence in favor of the suggestion that the high basal metabolism of the growing child may to some extent be accounted for by the amount of energy expended in the manufacture of new tissue. This is clearly quite a different point of view from that of other workers who ascribe high metabolism in infancy and childhood and its subsequent fall merely to an age change or just as unconvincingly to the hypothetical effect of a diminishing ratio between surface and mass as age advances.

latter could be true only of the upper curve (U_z) defining the course of heat production simply in Cal/Day

What is the cause of, and what the remedy for the paradox? We have already discussed the matter in a preceding paper,² but it is useful in connection with the present description of the curves in Fig 4, and also

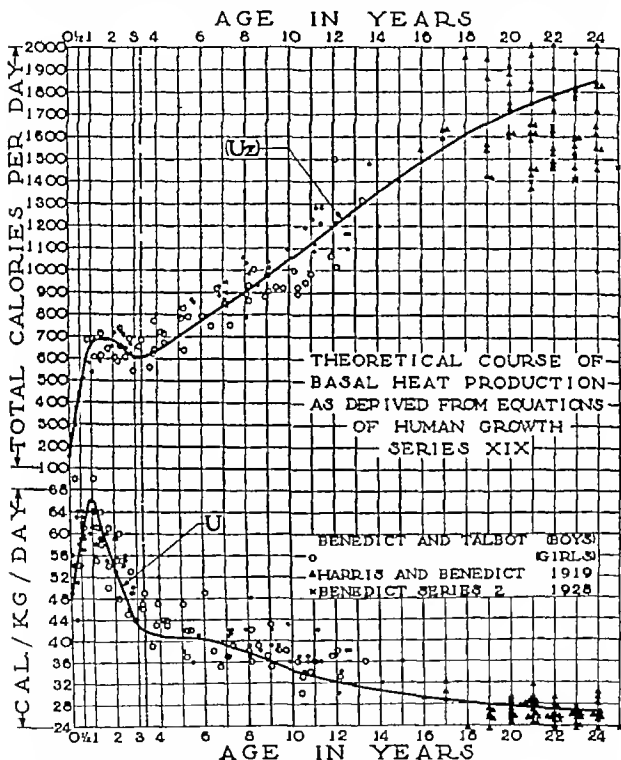


Fig. 4.—The curves of basal heat production as originally computed with the aid of the accompanying data indicated in the legend. The observations of Topper and Muller-Göttsche and of others are not included (though they follow these curves very well over their respective periods) because our equations were applied in the case of Series XIX solely to the data of Benedict and his coworkers.³

because of the rather considerable practical importance in having a clear understanding of the point, to inquire into the chief elements which contribute to possible confusion here.

The situation is briefly this

The term "metabolism" refers to the sum total exchange of energy in the basal state as judged conveniently by measurements of heat production. Thus, "metabolism" and heat production become conceptually related, but, since the latter is sometimes recorded in terms of Cal/Day and at other times as Cal/Kg/Day , it is easily possible to be led into thinking of metabolism in terms of either quantity interchangeably, the foregoing conflict being an almost inevitable result. The units themselves are, of course, equally valid, it is rather a question as to which is more appropriate. Two considerations come into play. There is, first, inherent in the basic idea of metabolism a tacit suggestion of reference to time, as well as to size, second, there is the purely practical problem of dealing with subjects of varying age, and hence of varying size, throughout the period of childhood growth, in addition to the problem of considering the natural deviations in size among children of the same age. It is, accordingly, held desirable to make comparisons of heat production in relation both to size and to time, i.e., *per Kg* and *per day*. Thus we see clearly that "metabolism" is more suitably expressed in terms of Cal/Kg/Day , the choice of mass as a measure of size being favored, as elsewhere pointed out,² on the ground that this, rather than surface area, is the more convenient, as well as the more appropriate unit, in which to evaluate changes in growing subjects.*

In spite of this full theoretical justification of regarding 'metabolism' as heat production preferably in Cal/Kg/Day , it turns out, somewhat unfortunately, that we must expect (from the mathematical connection between growth and heat output^{1, 2}) considerably less uniformity in data recorded in Cal/Kg/Day during the period of growth than in those expressed simply in terms of Cal/Day †. It can easily be shown from the same equations that the relative error in the former unit, engendered by a deviation in weight, will be about twice as great for any subject undergoing growth as the corresponding relative error in the latter. Where

*It will have been noted that we do not follow the widely prevalent clinical custom of defining daily rate of heat output per unit of size (Cal/Kg/Day or Cal/Sq M/Day) as metabolic rate. Such usage strictly speaking is incorrect since the quantity in question is not simply a rate but is rather a rate qualified per unit size. If it be found desirable to retain the phrase metabolic rate it will be necessary to select one of two possibilities (a) to define daily heat output as such or (b) to specify explicitly "basal metabolic rate per unit of weight" or when reference to surface is preferred as in Bruen's paper "basal metabolic rate per unit of surface." Each of the terms in (b) reverts incidentally to the definition given in (a) each possesses the theoretical advantages discussed in the text, and each would be satisfactory if consistently employed. The danger however is that the comparatively unwieldy terms in (b) would again be abbreviated to the incorrect form metabolic rate. These remarks afford further evidence for our own reasons in advancing the suggestion that the transactions of energy exchange conveniently regarded as metabolism be thought of in terms of Cal/Kg/Day . There should be no more difficulty in doing so than in accepting the speed of a train implicitly as miles per hour with the result that the dilemma of names otherwise engendered is automatically escaped. To us the most convincing argument in favor of the definitions we suggest comes from the fact that the equations of growth take their simplest form when each term has the same physical dimensions as metabolism, namely power per unit mass. From the dynamic standpoint (rate of energy expenditure per unit mass) growth and metabolism may therefore be considered as homogeneous transactions.

†An excellent illustration of this principle is to be seen in some recent curves on heat production in undernourished children reported by Tapper.⁴⁰

growth has ceased, or has become negligible, and hence where basal heat production is due simply to heat of maintenance ² (i.e., where $U = A' = 25.34 \text{ Cal/Kg/Day}$), we must expect instead to find much greater uniformity in values expressed in Cal/Kg/Day .

This curious though highly important situation whereby the two foregoing units of measure are characterized at different ages by precisely opposite degrees of reliability is explained most simply as follows: Taking the more common methods of expressing heat output, Cal/Day and Cal/Kg/Day and recalling that heat production during growth is due in part to growth and in part to heat of maintenance ² we have literally, in accordance with the symbolism of Table I

$$\text{Item 7: } (U) = \frac{\text{Daily Rate of Heat Production}}{\text{Involves Weight } () \text{ inversely}} = \underbrace{\left[\text{Heat of Growth} \right]}_{\text{Involves Weight } () \text{ inversely}} + \underbrace{\left[\text{Heat of Maintenance} \right]}_{\text{Involves Weight } () \text{ directly}}$$

and

$$\text{Item 8: } U' = \frac{\text{Daily Rate of Heat Production per Unit of Weight}}{\text{Involves Weight } () \text{ inversely as the square}} = \underbrace{\left[\text{Heat of Growth per Unit Weight} \right]}_{\text{Involves Weight } () \text{ inversely as the square}} + \underbrace{\left[\text{Heat of Maintenance per Unit Weight} = A \right]}_{\text{Independent of Weight}}$$

It will be clear from a study of the preceding scheme that item (8) heat production in Cal/Kg/Day (U'), must be more at the mercy of deviation in weight (since it involves the square of weight inversely) than the corresponding unit item (7) Cal/Day in which the inverse action of weight as regards heat of growth is bound for practical purposes to be fairly well counterbalanced by the direct entry of weight into the fraction due to maintenance. This precisely is the case when growth is not negligible but when growth has ceased the portions resulting from growth must vanish and it is clear that the foregoing relationships then become simply

$$(7a): (U_s) = \left[\frac{\text{Daily Rate of Heat Production}}{\text{Involving Weight } () \text{ directly}} \right] = \underbrace{\left[\text{Heat of Maintenance} \right]}_{\text{Involving Weight } () \text{ directly}}$$

and

$$(8a) \quad U = \left[\frac{\text{Daily Rate of Heat Production per Unit of Weight}}{\text{Independent of Weight}} \right] = \underbrace{\left[\text{Heat of Maintenance per Unit of Weight } A \right]}_{\text{Independent of Weight}}$$

In the latter circumstances accordingly, heat output in Cal/Day is alone bound to suffer in respect of deviations in weight the results in terms of this unit will therefore vary more widely, show greater scatter

when plotted, and will appear less uniform in comparison with data registered in Cal/Kg/Day because the latter is now, in the absence of growth, altogether independent of weight so far as the generation of heat is concerned.*

The foregoing theoretical results are clearly demonstrated by the respective curves in Fig 4 since the adjustment of (Uz) to the data is visibly better than that of U from birth to 16 years, whereas following this we actually find the reverse to be true†. Similar statements apply to observations on heat production in other organisms.

We are therefore faced in clinical pediatrics with the problem of evaluating the disadvantage of adhering, for the sake of consistency, to a unit of measure (Cal/Kg/Day) which, on the one hand, is itself theoretically desirable, but which, on the other, is always subject, where growing children are concerned, to a comparatively large relative error in practice, or, of dealing with the simpler unit, (Cal/Day), which suffers in turn from the theoretical defect of relating heat output solely to time, rather than to size as well as to time. Circumstances here, as elsewhere, are obviously bound to affect the final choice, but in summarizing this discussion it would seem fair to say that we ought, in working with such data, to consider the merits of these two units carefully, bearing in mind that the simpler unit, Cal/Day, is inherently subject to the lesser error during the entire period of growth, whereas, in speaking of "metabolism," we ought to reserve the use of this term specifically for

*It is necessary in such considerations to distinguish clearly between two fundamentally different issues: (I) the reliability of a result as based upon actual computation from the experimentally observed values of heat output and (II) the expected reliability as based upon the generation of heat in virtue of the dynamic connection between growth and heat production. The latter is subject to errors that occur in the basic data, the former to error that is imposed upon them. With regard to (I) a result calculated as Cal/Day from suitable measurements in calories that are then estimated for the 24-hour period is independent of weight so far as actual computation is concerned and it is therefore free from error due to weight. Turning to view the problem from the causal standpoint (II) as we do in the text above that a child of x Kg growing at the rate of g Kg/Kg/Day generates (let us say) y calories of heat in unit time we find instead just as outlined that daily rate of heat production (Uz) is actually a function on dynamic grounds of $\left[\frac{1}{\text{mass}}\right]$ whence U

must obviously be a function of $\left[\frac{1}{(\text{mass})^2}\right]$. Taking mass in terms of weight both quantities thus become susceptible to error resulting from deviation in weight as long as growth persists. The reliability of any final result so far as deviation in weight is concerned, will therefore be determined (discounting all technical discrepancies) in part by "error" arising out of (I) and in part by "error" from (II) whence values in Cal/Day will suffer during growth only from an error of generation. (II) Inherent in the measurements themselves whereas final values in Cal/Kg/Day will carry both the "error" in the data as well as that of (I) imposed by computation. Thus in either instance, U is seen to be more susceptible than (Uz) to deviations in weight as long as growth continues.

It must finally be remarked that the foregoing distinctions and results can be numerically corroborated only in data collected with the highest possible technical precision. In the latter respect no published observations exceed those of Benedict and Talbot,* or those of Du Bois† and few compare with them. It is consequently not to be expected that results obtained in ordinary routine clinical work will be sufficiently accurate to display these differences so strikingly.

†Had the observed weights in the corresponding data of Fig 4 not differed at all from the theoretical weights as given by z in Fig 1 we should have found the adjustment of U to be just as good as that of (Uz) from birth to 16 years any scatter still remaining along either curve during this period being due solely to technical differences in the measurements of heat output. Thus since U would be shifted more than (Uz) it is again evident that the former is the more sensitive to deviation in weight.

heat production as related both to time and to size. When so defined, it is no longer possible to mistake the meaning of the statement that metabolism tends to decline with age.

*Changes in Weight Rate of Gain and in Basal Heat Production
Inferred Simultaneously to Age*

By way of summary it will be useful with the aid of Fig. 5 to review the age changes of 'growth' together with those of "metabolism." Comparison is again made directly with respect to the more familiar trends of weight and rate of gain although it will also be well to keep in mind the corresponding phenomena of growth itself as already described in connection with Fig. 3.

The two epochs, circumnatal and adolescent, are dominated by the deflections in the curve displaying the rate of gain, \dot{w} , and the transition between these epochs is clearly indicated by the "trough" of velocity which thus marks out the period of relaxation in 'growth' associated with, and even peculiar to, the age of preschool life. While it is true that special characteristics appear in all of the curves at this time and that these clearly indicate the preschool pause in gain and in basal heat production, it may also be remarked that the slowly shifting changes between $1\frac{1}{2}$ and $4\frac{1}{2}$ years are least distinctive in the weight curve, the very one, in fact upon which we are compelled for the most part to depend in the usual routine of clinical work. The critical nature of this period is excellently brought out in the curves for heat production though it is illustrated best in the "double inflexion" in the upper graph, (U_2), the minimum of the latter at 3.30 years being coincident with that in the rate of gain. A striking array of fundamental physiologic events thus combine to stamp the preschool period as one of great transitions: critical changes in growth gain and in heat production are coupled with the equally significant changes in the blood at a time when the first dentition has just been completed and when the brain is almost fully developed. There can be little doubt that this is just as important a phase of childhood as the periods in which the rate of gain rises to and passes through its two great maxima.

CLINICAL SIGNIFICANCE OF CERTAIN EVENTS DURING THE FIRST OF THE TWO
MAJOR DEFLECTIONS IN THE RATE OF GAIN AND IN THE PAUSE
BETWEEN THEM

Circumnatal Epoch

There are several outstanding practical problems with which a pediatrician is bound to be concerned when dealing with subjects in this stage of life. Taking these in chronologic order we meet first the problem of growth in the premature baby, the physiologic loss of weight at normal birth, and lastly the matter of gain, or rate of gain during early

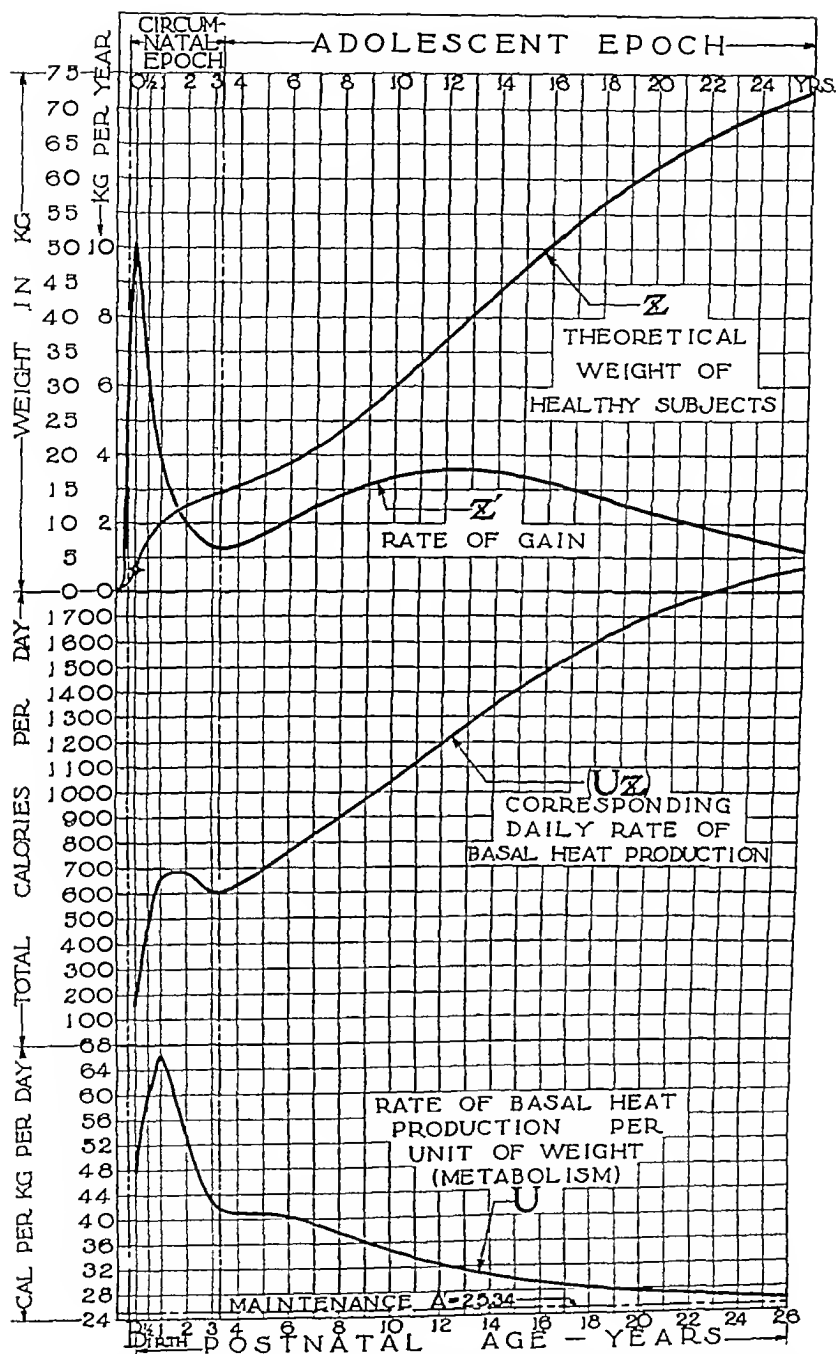


Fig. 5.—The theoretical trends of basal heat production compared with weight and rate of gain. It may be observed in the lower section that the area between U and the maintenance level represents the portion of heat in Cal/Kg/Day which is produced by and is due to growth.

infancy. Worth noting here, though not of direct practical significance is the fundamental biologic problem of the cause of birth for it is not without interest that the normal full term child should be born at the very peak of its rate of gain as shown in curves z of Figs 1, 3 and 5.

Prematurity—It is now somewhat simpler to understand in view of what we have just noted, why the care of a premature infant should be proportionately more difficult than that of the full term child other things remaining approximately the same.

The chief difficulty of course, is its want of "ripeness" here expressed and represented in the fact that such an infant is endowed with the propensity of climbing to its succeeding peak velocity * which is naturally scheduled to take a month or so beyond but is required to attempt this under conditions that are removed from the favorable circumstances of intrauterine existence. It is not common, as far as present records on the subject go to have the smaller premature babies traverse a course of gain in weight at the rates here indicated for the latter portion of fetal life. Such gains in the case of a 1000 gm premature infant would call for reduplication in weight within forty-four days of its birth and the resulting weight curve could be directly superimposed upon the respective segment in Fig 2. Sufficient experience has already accumulated to show that this curve can be very closely approximated under certain special conditions of feeding and care. Real emphasis must be placed upon the point that the difficulties of rearing premature infants are occasioned largely if not entirely by the dynamic stresses of growth which these infants are required to withstand and to overcome under the comparatively adverse conditions of extrauterine life. No food, however well chosen, can eliminate such stresses as these which arise during periods of natural or intrinsic acceleration in the rate of gain. Proper feeding and careful hygiene for premature infants will do much to minimize the additional risk that this particular burden of growth implies.

Physiologic Loss of Weight at Birth—If the several curves we have now been investigating had been drawn simply by eye through the respective data each represents it would have been necessary to include at birth a slight but definite break or downward deflection in the curve for weight, z followed by a two-week period of recovery. To correspond with this the velocity curve z would have shown a similar, though greater change (on the basis of scale), and would even have fallen below zero during the period of loss in weight only to rise to the peak already shown when growth had once more become reestablished at the end of the neonatal period. The two curves in question have been obtained by a different method, and they represent in continuous fashion what may for theoretical purposes at least, be considered the "ideal" tendency and

* Dynamically equivalent to peak momentum per unit length.

trend of these two special aspects of human growth. The "physiologic" loss of weight in the newborn does not appear in them, and it fails to appear because the equations from which these curves have been computed are based upon the assumption that nutriment is just as available to a newborn infant as it is throughout the entire course of growth. Since this is usually not the case at and for a short time after birth, it is necessary from the dynamic point of view to regard the physiologic loss of weight as an accidental and not as a fundamental event in the clinical careers of all newborn babies. Sufficient support for this conclusion is to be found in various studies on the point,^{11 41} for it has been shown that loss of weight at this time can be prevented when infants tolerate the required quantities of food.* But the clinical advantage of doing so is certainly a questionable one, chiefly because the onset of lactation may be considerably delayed. Such attempts, as Shick⁴¹ has remarked, are more than likely to be superfluous, for the milk supply is soon established under ordinary circumstances and normal gains quite promptly ensue.

Rate of Gain in Weight During Infancy—From our own studies^{1 2 3} we have come gradually but definitely to the conclusion that there is no problem of infantile growth which merits more consideration on the clinical side than that pertaining directly or indirectly to the rate of gain. There is a well-known tendency in some quarters to regard this particular aspect of growth indifferently although it cannot easily be denied that the almost universal practice of some kind of regulation in the quantity, number, and time of breast or artificial feedings is carried on, whether explicitly or not, through the realization of the fundamental importance of promoting normal and of preventing abnormal gains.

The results to which we refer speak strongly in favor of deliberate moderation in the matter of raising big babies. Consider once more curve *z'* in Figs 1 and 5. Close examination here shows that this curve rises practically from zero in the early days of gestation to the value of 10.146 Kg per year, or 27.80 gm per day at birth. Succeeding this, except for the physiologic loss already discussed, the rate of gain falls swiftly (on the annual basis of time) to the value of 17.97 gm per day at six months and to 10.45 gm per day at the end of the first year. These values agree with an old pediatric rule of the thumb to the effect that a normal baby should gain, on the average, an ounce a day during the first six months and about half an ounce a day during the second six months of life. But experience shows that, in spite of this axiom, many parents and a goodly number of physicians as well still take an unjustified pride in great and rapid gains. We see all too frequently a baby whose record is marred by gains of 10 or 12 ounces and even more per week. Such an infant, up to the moment of examination, has

*Compare also MacDowell's⁴² interesting observations on the part which a limited supply of food plays in determining gain in weight among newborn mice.

usually escaped the certain fate that succeeds excessive increments of weight, and it is chiefly on this account that both physician and parent are apt to treat the problem lightly.

What are the objections that may be raised against the practice of allowing infants to gain more rapidly than the traditional canon allows? Leaving the well known clinical and pathologic consequences of overfeeding quite aside (since the latter is by far the most common cause of excessive gain in early life), there are in reality, two important disadvantages which are forcibly brought to our attention from the dynamic side of the problem. In the first place abnormally high rates of gain are bound to be followed by equally abnormal low rates of increase and they may indeed be succeeded by periods of actual loss as well. Experience itself has sufficiently substantiated this, but the result may likewise be easily demonstrated by the following consideration.

The area enclosed by the velocity curve z' Fig 5, is exactly equal to the actual weight w at corresponding points or ages, the total area thereunder being the final adult weight. If we distort this curve in any portion, for example, along the segment covering the first six months where excessive rates are most frequently witnessed from overfeeding it must clearly follow to keep the total area the same, that an equivalent distortion in the direction of a lower velocity must subsequently be introduced. The normal period of adjustment already noted and described as a period of comparative rest and preparation for the secondary climb in later childhood, is thereby unavoidably lengthened compensation even in the matter of velocity is unescapable. Witness the infant who doubles his weight in the first three months and then fails to gain even normally, in spite of efforts to the contrary until 'age has caught up with weight'.

Thus far we have counted the cost of great gains merely in terms of a subsequent needless delay in growth. But a second and to us, an even more important disadvantage on dynamic grounds is to be found in the fact that doubling the rate of growth i.e. the relative rate of gain (Table I) creates when other things remain the same a four fold increase in that portion of energy which is necessarily dissipated per unit of time in every instance of growth even under natural or more normal conditions of reduplication. The energy so dissipated appears in the form of heat and tends thereby to raise the basal metabolic output of heat correspondingly.² What physiologic devices there are to neutralize this waste we do not know, nor can we be sure that harm will not be done by stimulating rates of gain exceeding those which long experience justly considers optimal in the human case. Thus, as our studies suggest it would appear unquestionably better to avoid these difficulties entirely, if for no other reason than to prevent a "growth fuse" from burning out.

We come therefore to three major conclusions, in respect of rate of gain, which may be summed up as follows first, that it is unnecessary

to promote a gain of more than an ounce a day on the average at any time of life, and to expect that rate only during the very first trimester, second, that excessive rates of gain will be followed by periods of delay in growth, and third, that such rates are accompanied by, and give rise to, even greater rates of energy dissipation. These conclusions are reached from a study of the dynamics of growth, but they cannot, obviously, be applied on the clinical side without full recognition that equally healthy infants differ greatly, and that such differences cannot be entirely disregarded in the problems of their individual care.

The emphasis which has just been placed upon the dynamic importance of preventing excessive and of encouraging normal rates of gain requires a final word of comment. A counter objection might, for example, be raised to the effect that recent studies in the nutrition of white rats⁴³ have shown no demonstrable difference between animals forced to gain at a rate twice that considered by modern practice to represent the normal for the species. Health, development, and the common "anthropometric" measurements of the two groups were the same, no objective differentiation between them having been found possible. On this ground alone, there might be reason to believe that rate of gain per se could be disregarded in the matter of infant feeding. Yet, neglecting several important differences in the two cases under examination, we know it is well from the clinical side to recall the familiar rule that, in the last analysis, the human baby, and not the rat, must be the subject of any such *experimentum crucis*. From the theoretical side we should be justified, perhaps with greater reason, in suspecting that normal growth in rats requires further investigation. For it is quite unthinkable that the usual maximum rate in the human case, 1 ounce per day, could be doubled and maintained over any significant interval at the level of 2 ounces a day without leading to a "break", whence, in judging the comparative ability to withstand the strain of distorting their respective curves of rate of gain, we should be required to conclude that the standards of optimal growth for the rat and for the human infant are, as yet, not strictly comparable. Even though they were, it would still be necessary to regard most seriously the striking fact that the normal maximum rate of gain in the human case is slightly less than an ounce a day. On dynamic grounds at least, there is no need, and we are obliged to add, still less wisdom in attempting to exceed this rate. From the purely practical side of the matter it is sufficient to remember only the simplest and indeed safest rule of all, namely, that no infant requires to gain more than one ounce a day to assure its full attainment of growth.

Preschool Pause

This period, as already mentioned in an earlier section and as shown in Figs 1 to 5, extends somewhat in either direction from the line of demarcation between the circumnatal and adolescent phases of growth.

Its conspicuous characteristic, as the name implies is the halt in the velocities of gain and growth as shown by curves z' and q although each of the other three curves likewise passes simultaneously through a period of comparative rest. This is of definite clinical importance, for it has not always been clearly recognized that gain, and hence growth, slows down remarkably here. Since there is an even greater change in the trend of basal heat production during the period in question it will be better to discuss the preschool pause from the latter standpoint.

The Leveling Off in Basal Rate of Heat Production from 1 to 4½ Years—Attention has already been drawn to the curious 'double inflexion' between the ages of 1 and 4½ years in curve (U_2) of Figs. 4 and 5 representing basal heat output in Cal./Day. The maximum value is reached at approximately 18 months and the succeeding minimum at about 3.30 years the total variation between the two extremes being something less than 100 Cal./Day. In spite of this completely unexpected result in our original computations we found as fig. 4 shows that the data of Benedict and Talbot* were distributed nicely about the entire curve and notably so over the interval just now under examination. The exact trend of the curve depends upon certain mathematical relations between growth and simultaneous heat production but it is clear if we consider the technical difficulties in making observations of heat production on subjects of this age and allow for unavoidable scatter in the results, that the complicated course of the curve during preschool life could hardly be traced on the basis of experiment alone*. Still the measurements at this stage easily display a definite halt in the otherwise upward march of affairs and they confirm the retardation which is clearly brought out in the curve itself. Such a course of events is quite naturally of considerable interest on both the dynamic as well as on the clinical side of the problem. It is not difficult from the former standpoint to understand why the curve should behave in such a peculiar fashion nor is it easy once this leveling stage is recognized to avoid hazarding an interpretation as its clinical significance. Among other things† it seems to touch fundamentally upon the extremely important and rather common complaint of childhood anorexia.

One of the most fundamental distinctions arising in analytical work is exemplified here, for it may be noted that curves U and (U_2) have been obtained by applying our equations, as developed on independent grounds, to data on heat production rather than by attempting to deduce the trends directly from or out of the original set of observations. A similar remark applies to the weight curve z .

†The intriguing deflections in (U_2) and in U of Figs. 4 and 5 are, biologically speaking, the direct counterpart of similar postnatal, or even prenatal, events in other organisms, namely in the toad, chick pigeon, rabbit, pig, guinea pig and calf. These are superlatively set forth and interpreted in the monumental work of Needham. Since then, additional data reported by Riddle, Nussmann and Benedict, disclose similar phenomena in another race of pigeons. Exactly the same fundamental features are to be found in the curves for heat production among unicellular organisms exemplified in the painstaking work of Bayne Jones and Rhee, as well as in the later data by Schmidt. The peaks and troughs of metabolism in all of these cases are generically related to the basic dynamic properties and events of growth, their connection with growth being most directly expressed by means of the equations we have elsewhere described. With this scheme of unification in mind opportunities for further work become almost boundless.

Physiologic Basis of Preschool Anorexia—Consider for a moment the following course of reasoning. A healthy baby requires, on the whole, more and more food as it grows older and as it gains in weight. This general rule applies with greatest force, as we may infer, to the first year of life and to the period succeeding the age of five years. During the period between these ages there seems to be good reason that a mother, not necessarily an overzealous one, should seek an explanation of some kind when she finds a thriving, active, and healthy infant, fifteen months old, manifest no additional interest in food that does not remarkably exceed the quantity or differ much in kind from the habitual menu of the preceding 3 to 6 months. Having observed the definitely increasing quantities which the baby's appetite demanded during the first year, she is bound to expect further and regular additions now. Something more than solicitude is likely to develop, when she realizes that the day's supply at eighteen months, at 2 years, even at $2\frac{1}{2}$, 3, and 4 years differs so insignificantly from that required during the previous stages of this epoch. Did not the one-year-old baby take a quart of milk vigorously, a volume that has gradually been reduced to two or three glasses a day? Have not the five meals of infancy been cut to four and then to three? The mush and vegetables remain the same, and the child, now fully a year or two beyond, lives literally on air! Small wonder that certain mothers should become unduly disturbed by this failure to eat and this obvious loss of appetite! As proof for their contention they are likewise apt to point out that the child has also failed, in comparison with the year before, to accomplish its expected gain.

Is it not perhaps deeply significant that this oft-repeated episode should fall precisely at the very period when basal heat production, as demonstrated by this curve, is oscillating with comparatively small amplitude about the 650 Cal./Day level and, as we have also seen, just at the time when growth and gain are likewise at their lower levels? For the frequency of anorexia, whether real or unreal, during early childhood is attested to in the experience of every pediatrician. On the basis of the present computations, as displayed in the foregoing curves, it seems altogether logical to conclude that a child's appetite is rather definitely, if not entirely, controlled by the basic physiologic mechanisms concerned with the fundamental processes of growth and metabolism. The striking fact is that heat production throughout this stage of life is at low tide, as is growth itself, and it seems unlikely, in consequence, that the call for food should be great when the basal rate of energy expenditure is so distinctly retarded and even slightly reversed.

Before leaving this question we should note that the values for heat production given in Figs 4 and 5 do not refer to total daily energy requirements. The latter are obviously always greater than heat output, or no growth of any kind could be accomplished. An allowance of

about 1 000 to 1 500 Cal /Day or between 400 and 750 Cal in excess of "basal needs" is known¹² to be sufficient for the purpose of creating new cells for storage, activity, and for other expenditure during pre-school life

To sum up, the basic events here emphasized are those in which we have seen a clearly defined halt in heat production, in the rate of gain, and in growth itself. We are inclined therefore to infer that the *physiologic* basis of preschool anorexia is to be found in a lesser demand for energy on the part of a healthy organism during the very years in which there is comparative "rest" in "the motion of growth"¹³

SUMMARY

Relying upon material embodied in preceding papers of this series as a guide we have here reviewed certain problems of human growth and metabolism which possess noteworthy clinical importance. The results apply chiefly to infancy and to preschool life, and they may be summarized as follows:

1 Matters of human growth are comprehended best when treated hand in hand with those of basal heat production. To this end individual attention has therefore been paid to careful definition and explanation of terms, more especially to 'growth' and 'gain' on the one side, and to "heat production" and 'metabolism' on the other.

2 Growth cannot be properly understood by studying merely successive change in size. The latter is but one of many items equally important to the solution of any problem in this field.

3 Seven additional items are tabulated: these, acting in conjunction with the fundamental properties of growth resistance ρ , inductance λ , and permittance κ we have previously defined, are dynamically responsible for the changes in size that result in cumulative gain. Together they characterize the various states of growth through which healthy subjects habitually pass.

4 Life trends of growth and rate of growth and the corresponding trends of basal heat production are compared with the more familiar curves of cumulative weight and rate of gain. The chief events are most conveniently grouped about the two major deflections (circumnatal and adolescent) in the rate of gain and in the pause between them. Normal full term birth takes place at the moment when the rate of gain in weight has reached the highest peak of life. This maximum value in health is slightly less on the average than 1 ounce (27.8 gm.) per day. The rates of gain and growth both slow down remarkably during pre-school life to reach their individual minima at 3.30 and 3.65 years respectively. Thereafter they rise to more widely separated maxima during adolescence.

¹² It is finally of interest that Plato had classified growth as the sixth in a group of ten kinds of motion.¹⁴

5 The production of heat to which the term "metabolism" most suitably refers is measured in *Cal /Kg /Day*, because it is held desirable, in dealing with subjects of varying age and hence of varying size, to make comparisons of heat output in relation both to size as well as to time. But the simpler unit, *Cal /Day*, is inherently subject, so long as growth persists, to the lesser relative error in respect of weight, though it suffers the theoretical defect of relating heat output solely to time, rather than to size as well as to time. When growth has ceased, the reverse is true.

6 One of the difficulties of rearing premature infants appears to exist in the stresses of growth which these subjects are required to withstand and to overcome under the comparatively adverse conditions of extra-uterine existence. Such stresses arise during periods of natural acceleration in the rate of gain and they cannot be eliminated by external adjustments of any kind. They constitute additional risks which may be minimized by proper feeding and care.

7 From the dynamic point of view we regard the physiologic loss of weight at birth as an accidental and not as a fundamental event in the clinical careers of newborn infants.

8 Excessive rates of gain during infancy are followed by periods of delay in growth, such rates being accompanied by, and giving rise to, even greater rates of energy dissipation.

9 It appears unwise even in the face of the great individual differences so frequently witnessed in practice, to infringe upon the rule that no healthy infant requires to gain more than one ounce a day to assure its full attainment of growth.

10 Growth, gain, and basal heat production are all at low tide during preschool life. The year between three and four is most conspicuous in this respect.

11 The leveling-off of heat production between 1 and 4½ years seems to touch fundamentally upon the problem of preschool anorexia. We conclude that the *physiologic* basis of this oft-repeated event is to be found in a relatively low demand for energy on the part of a healthy organism during the very years in which we see comparative "rest" in the "motion of growth."

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SIMPLIFYING THE PROBLEM OF INFANTILE ECZEMA

AN ANALYSIS OF 157 CASES

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THE classification of infantile eczema as a symptom of allergy has done much to simplify a difficult problem. It has also placed treatment on a more rational basis. While many cases are still baffling, especially those which have become chronic, knowledge of the more common etiologic factors makes the study less complicated.

FREQUENCY OF OCCURRENCE

In a previous paper¹ on eczema I reported a study of 989 children between the ages of one month and four years, with an incidence of 6 per cent.

IMPORTANCE OF FAMILY HISTORY OF ALLERGY

Of 157 cases studied, there was a positive family history of asthma, eczema, or some other symptom of allergy, in 109 cases, or 69 per cent. There was no history of allergy in thirty-nine cases or 25 per cent, and an unknown history in nine cases, or 6 per cent.

Balyeat² reports a positive family history of allergy in 76.6 per cent of a series of 181 cases of eczema.

O'Keefe and Rackemann³ found only 28 per cent with positive family histories in their series of 212 cases.

Hill⁴ is of the opinion that true hereditary transmission is relatively unimportant in eczema.

In the larger group of 220 cases I have seen, the incidence of allergy in the family history is well above 50 per cent and I believe that heredity is a strong predisposing factor in eczema.

DIFFERENTIAL DIAGNOSIS

There is a wide variety of skin diseases easily confused with eczema. Table I lists ten such diseases which were sent to the Central Presby

TABLE I
CONDITIONS CONFUSED WITH ECZEMA

	12 cases
Seborrheic Dermatitis	5 "
Impetigo Contagiosa	5 "
Napkin Dermatitis	5 "
Scabies	4 "
Ichthyosis	2 "
Mercurial Dermatitis	3 "
Ringworm	2 "
Paronychia	1 "
Pityriasis Rosea	1 "
Syphilis	1 "

terian Clinic with diagnoses of infantile eczema. The table gives some idea of the relative importance in differential diagnosis.

ETIOLOGIC FACTORS

Scratch testing provides a simple and in the very young, a reliable method of diagnosis of infantile eczema. The skin of infants reacts readily, though with widely varying degrees of intensity, to the application of powdered extracts. The reaction in my experience, has much more frequently been an erythematous area around the scratch than a true wheal. Any reaction greater than the control should be regarded as important.

Common foods, as shown in Table II, are almost exclusively responsible for infantile eczema. If sensitization to unusual or occasional foods is present, the result is usually a transient urticaria rather than an eczema.

As the age of the child increases, the importance of foods as etiologic factors decreases and contact dermatitis as described by Bloch,⁵ Shelmire⁶ and others, assumes a place of much greater importance. It would seem that the eczemas of infancy and early childhood are largely of endogenous origin.

TABLE II
SHOWING FREQUENCY OF SKIN REACTIONS

Cow's milk alone	35 cases	Milk in combination	80 cases
Eggs alone	0 "	Eggs in combination	69 "
Cereals alone	0 "	Cereals in combination	53 "
Oranges alone	2 "	Oranges in combination	10 "
Tomatoes alone	1 "	Tomatoes in combination	6 "
Unusual foods alone	0 "	Unusual foods in combination	14 "
Causes undetermined		17 cases	

It is evident that milk is the greatest single causative factor in this series. In the thirty-five cases in which it was the only factor, 70 per cent of the patients were under six months of age. Milk sensitization would seem to occur very early, probably in utero.

Eggs alone accounted for only six cases. Of these 50 per cent were under six months of age and evidently had acquired sensitization through the mother. Eggs, in combination with other foods were involved in sixty-nine cases.

Cereals alone did not account for any cases, but in combination were responsible in forty-nine cases. Forty-seven per cent of the cereal reactions were in infants between six and twelve months old.

Milk, eggs and cereals accounted for 126 cases, or 80 per cent of those studied.

Table II brings out the very important fact that sensitizations are usually to more than one food. This explains the difficulties of diagnosis by diet elimination alone as described by Rowe,⁷ Waters,⁸ Dale and Thornburg,⁹ and Hopkins et al.¹⁰

TREATMENT

Local treatment was avoided, excepting the use of white vaseline, so that whatever results were obtained could be properly evaluated. Offending foods were eliminated and, where necessary, substitutes were given.

Vaughan¹¹ and Ellis¹² emphasize the importance of group sensitization to foods having a common biologic origin. For instance, an infant sensitive to cow's milk is rarely able to use goat's milk as a substitute. Sensitivity to wheat frequently means sensitivity to other cereals such as oats and rice. Failure to recognize this fact causes many disappointments in treatment. Groups of common origin should certainly be eliminated in beginning treatment.

Slightly milk-sensitive infants often are able to tolerate a formula of evaporated milk heated to the boiling point for two or three hours. Soy bean milk has been the most satisfactory substitute where milk alone is responsible for the eczema. I have used it satisfactorily in twenty nine out of thirty-two such cases. It contains a considerable quantity of cereals, and for that reason is often a failure as a substitute in infants who are sensitive to cereals as well as milk. Cohen et al.¹³ have introduced a milk-, cereal-, and egg-free diet, which should fill an important need. From a practical standpoint it is too expensive to be widely used, and I have had difficulty because of its lack of palatability.

Every trace of the guilty foods should be removed from the diet for a period of two or three months. Frequently this is not done by the mother who fails to realize the frequency with which common foods, such as milk, eggs, and wheat, are used in preparing other foods.

Waters⁶ calls attention to the ingredients of some of the common foods which frequently contain small amounts of the prohibited proteins. For instance, milk is contained in such foods as butter, cheese, ice cream, macaroni, margarine, white bread, puddings, cream soups, cakes, malted milk, milk chocolate, waffles, and pancakes. Eggs are found in mayonnaise, noodles, custards, milk puddings, rolls that are glazed with eggs, cakes or cookies, soft or filled candies, ice cream, hot breads, and chocolate preparations such as Ovaltine. Wheat is found in all breads, crackers, cakes and cookies, any foods using flour for thickening, malted milk, spaghetti, macaroni, noodles, breakfast cereals, rye bread, and oatmeal cookies.

After complete elimination for a time, it is usually possible to return to the guilty foods slowly, one by one, without trouble. Nature eventually takes care of most of the desensitization.

RESULTS

Table III shows the results obtained in this series of cases. The number of complete recoveries is high, perhaps too high, and probably would not hold for a larger series. Reasons for the favorable results are that

77 per cent of the patients were under two years of age, that the skin of infants and young children is much more sensitive to testing and gives fewer false positive reactions and that common foods are largely responsible in this age group. Contact sensitization, which occurs later, is not a factor of importance in infancy, and hence one of the chief complicating difficulties in diagnosis and treatment is removed. The fact that chronic eczema is seen infrequently in the very young helps to give a higher percentage of recoveries.

TABLE III

Complete recoveries	14—74.5 per cent
Improved	17—90 per cent
Failures	20—105 per cent

CONCLUSIONS

- 1 Most true infantile eczemas are probably allergic in origin.
- 2 Milk is the most important single factor in the production of infantile eczema. Eggs are next in importance and cereals complete the group of foods responsible for the majority of infantile eczemas.
- 3 Sensitization to more than one food is more common than sensitization to a single food.
- 4 Skin testing by the scratch method is both reliable and simple in the very young.
- 5 Sensitization to more than one food makes the diagnosis by diet elimination difficult.
- 6 Treatment by elimination of offending foods seems to be a logical plan. Soothing local treatment helps to increase the rapidity of recovery.

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ACRODYNIA

(ERYTHREDEMA, POLYNEURITIS, VEGETATIVE NEUROSIS, PINK, OR
SWIFT DISEASE)

A HISTOPATHOLOGIC STUDY OF THE NERVOUS SYSTEM

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THE clinical aspects of acrodynia are well known and established. The etiology of the disease is still obscure. Infection, toxins and dietary deficiency have been considered as causative agents. The scanty and conflicting pathologic reports, especially of the nervous system, warrant a complete report of this case.

REPORT OF CASE

W K, a boy, aged two years, suffered from loss of weight, anorexia, diarrhea, irritability and a rash. About the latter part of March, 1931, the patient fell twice from a height of about four feet, striking the back of his head. Following this, he began to refuse food, became irritable, and lost considerable weight. He would rock from side to side, forward and backward, until he fell on his back exhausted. On these occasions his penis was noticed to be erect. He would bang his head against the crib and would bite on his right big toe unless restrained. The stools became loose, bulky, and frequent. A rash first appeared on his face and later spread to the trunk. The soles of the feet and the palms of the hands became red, shiny, and peeled.

History—The patient, a first child, was normally delivered at term, and weighed 6 pounds. He was breast fed for 4 months, but did not gain in weight. After he had been placed on an evaporated milk formula, cod liver oil and orange juice, his weight increased to 20 pounds at one year of age. For the next six months he received Imperial Granum and cow's milk, as well as cereals and vegetables. He continued to gain until the onset of the present illness when he weighed about 25 pounds. He sat up at 8 months, had his first teeth at about the same time, and walked at 12 months. He was exposed to tuberculosis in the paternal grandmother for a short time.

Examination—The patient first seen on June 23, 1931, was poorly nourished, irritable and tried to bite on his toes through the shoes. A few impetiginous lesions were present on the chest. A red, raw looking, papuloulcerative rash covered the buttocks, scrotum, and anterior surface of the penis. The soles and palms were red and peeling. The cervical glands were slightly enlarged and firm. The pupils reacted to light and in accommodation, and the deep reflexes were normal. There was no evidence of rickets, the fontanels were closed. Eighteen sound teeth were present. The heart and lungs were negative. The liver and spleen were not palpable. The blood pressure was 90 systolic and 60 diastolic.

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Course.—The stools improved on ordinary protein milk. Any other addition to the diet, such as banana, orange juice or cheese caused them to become loose. The patient continued to suck his hands and to bite anything he could get into his mouth. The arms and legs were splinted but despite this the nails of the right big and middle toes were gone. Quartz lamp treatments were given twice a week. On August 6 1931 his weight was reduced to 17 pounds.

On August 2 the rectum prolapsed with each bowel movement. The right and left big toes became ulcerated and the metatarsal bone of the right big toe was exposed. All the nails of the right foot except that of the small toe were gone. The inguinal glands were swollen. With the administration of atropine the soles and palms lost their redness, but continued to peel. The patient was admitted to the Barnert Hospital on September 4 and except for a few impetiginous lesions about the mouth and swelling of the feet, his condition remained unchanged. The blood pressure was 115 systolic and 70 diastolic.

Laboratory data.—Urinalysis was negative except for a positive urobilinogen test on one occasion and an occasional pus cell and red blood cell two other times. Examination of the blood revealed 3,700,000 red blood cells, 62 per cent hemoglobin, 16,800 white blood cells, 26 per cent lymphocytes, 2 per cent large mononuclears, 4 per cent eosinophils, and 68 per cent neutrophils. The blood Wassermann, Meinknecht and Mantoux (1.0 mg.) tests were negative. A roentgenogram of the chest was normal. Stool examinations were negative for ova and parasites. It revealed abundant amounts of starch and fat but no neutral fat. Blood calcium was 10.2 mg. per cent and phosphorus 5 mg. per cent.

Course in the hospital.—The patient lost weight progressively. He sweated profusely about the head. When he was restrained, he lay quietly on his back; but as soon as the limbs were released he would rub his hands and feet against each other or on the mattress. On September 9 the blood pressure was 128 systolic, and 70 diastolic. A direct blood transfusion was given the following week. During the first two weeks in the hospital the temperature varied from 90 to 101; during the last week it was subnormal. The extremities became cyanosed and the patient died on September 26, 1931.

AUTOPSY

A necropsy was performed by Dr. H. Wassing soon after death. The body was extremely wasted. There was necrosis of the distal phalanx of the right big toe with involvement of the head of the metatarsal superficially. The skull presented no abnormalities. The thymus was small and weighed $3\frac{1}{4}$ grams. The liver was mottled and, on section showed grossly grayish yellow areas alternating with hyperemic reddish brown areas. The spleen showed macroscopically no lymph follicles. The pancreas, adrenals, and the kidneys were normal. The entire large intestine and ileum disclosed marked atrophy of the mucosa and Peyer's patches. All the other organs were normal.

Microscopic examination of the internal organs was negative. A section of the skin of the palmar surface of the index finger stained with hematoxylin and eosin showed the usual increase in depth of the epidermis, mainly the result of the increase in the stratum corneum. There was no parakeratosis. The sweat ducts and glands were normal. The capillaries in the subpapillary zone were increased in number and slightly hypertrophied; these were lined with slightly hypertrophied endothelium. There was a moderate edema in the subpapillary and papillary zones surrounding the larger capillaries. The collagenous tissue seemed degenerated in areas and was edematous throughout. The elastic tissue could not be judged by this stain. The subcutaneous fat and the nerve fibers which could be identified were normal. The conspicuous features were (1) dilatation of the capillaries of the papillary and

subpapillary zone with slight endothelial hypertrophy, and (2) moderate edema of the cutis with occasional focal areas of collagenous degeneration

Nervous system—(*Gross examination*) The brain was cut horizontally. There was a slight discoloration of the putamen and caudate.

(*Microscopic examination*) Sections from the various parts of the cortex, basal ganglia, pons, cerebellum, high cervical cord, and peripheral nerves were stained with the myelin sheath, cresyl violet, Bielschowsky, and Sudan IV methods.

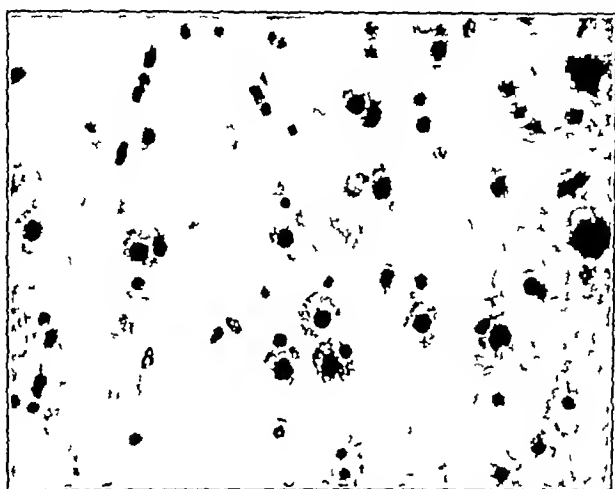


Fig 1—Nerve cells from the third cortical lamina showing swelling, loss in Nissl substance and deeply stained nuclei (Severe nerve cell disintegration of Nissl). Cresyl violet stain $\times 400$.



Fig 2—Swelling of the Purkinje cells, loss in chromatin material (homogeneity) and poorly stained cytoplasm and nucleus. Cresyl violet $\times 400$.

Brain (Cortex) There was a slight disarrangement of the cytoarchitecture of all the cortical laminae, mostly those of the third layer. The ganglion cells of all the cortical laminae, mostly those of the third layer, were swollen; their outlines were indistinct and the Nissl substance stained poorly; the nuclei and nucleoli were deeply stained but were not displaced to the periphery (Fig 1). Complete chromatolysis and falling out of single ganglion cells were also observed. There was a slight increase in the glia nuclei. The cortical

vessels were slightly engorged. Fatty granules and droplets were found in the ganglion and glia cells and in the walls of the blood vessels.

Basal ganglia. Horizontal sections of the brain through the island of Reil including the putamen caudate, and part of the thalamus disclosed swelling of the ganglion cells of the neostriatum and thalamic nuclei; these nerve cells were not as extensively diseased as those in the cortex. The large ganglion cells of the striatum were more swollen than the small nerve cells. The nerve cells of the tuber cinereum appeared normal. The ependyma except for a slight subependymal reaction, was normal. The ganglion cells of the cortical convolutions of the island of Reil showed the same changes as those described in the other cortical convolutions. Fatty deposits were also found in the nerve and glia cells and the walls of the blood vessels of all these structures.

Pons and cerebellum. There was insignificant palling of the corticobulbar fibers. The Purkinje cells of the cerebellum were swollen; they were poor in chromatin and their processes could not be visualized in the cresyl violet sections (Fig. 2). The glia cells were also swollen. In the Bielschowsky preparation a number of the

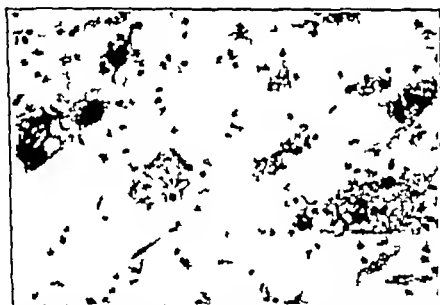


Fig. 2.—Severe cell changes of Nissl in the nerve cells of the locus ceruleus with decrease in pigment, vacuolization and loss in outline of the cells. Cresyl violet stain. $\times 350$

Purkinje cells showed absence of the fibrillary processes; their axones and dendrites were swollen and their fibrillae had disappeared. The nerve cells of the locus ceruleus were swollen, vacuolated, devoid of iron pigment and showed the severe cell changes of Nissl (Fig. 3). The other ganglion cells about the fourth ventricle and the pons were also slightly swollen, but not quite as markedly as those of the locus ceruleus. The vessels were slightly engorged. The ependyma of the fourth ventricle was normal.

Spinal cord. Only a section from the high cervical region, in close proximity to the crossing of the pyramids was obtained. The ventrolateral tracts took the myelin stain quite poorly (Fig. 4). With higher magnification disintegration of single fibers was seen in the spinoolivary and dorso-spino-cerebellar pathways (Fig. 5). The posterior columns were normal. The disintegration in the above tracts was mild in degree. The occasional disintegration of a single fiber of the lateral pyramidal tracts was also noticed. The motor cells of the nucleus ventralis of the eleventh nerve and of the anterior horn cells showed loss of Nissl substance and vacuolization (Fig. 6). Swelling as seen in the cortex

was not observed. Most of the changes were in the ventrolateral and ventromesial cell columns. The cervical cells of the nuclei of Stilling and of the substantia gelatinosa rolandi were normal.

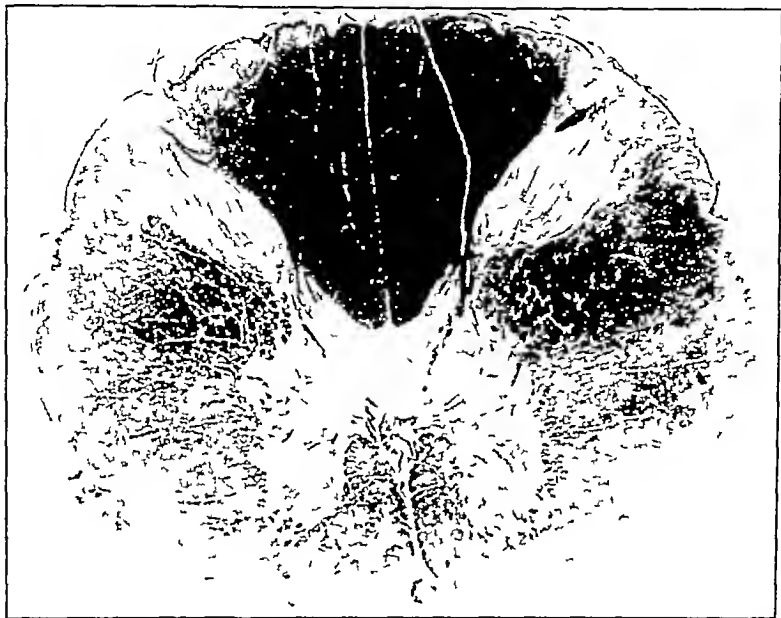


Fig. 4—High cervical region showing marked poverty and paleness in the staining quality of the ventrolateral tracts. The posterior columns are intact. Myelin sheath stain.



Fig. 5—Disintegration of the myelin sheaths in the spinoolivary and cerebellar pathways. Myelin sheath stain. $\times 300$.

Peripheral nerves. In the sections stained for myelin sheaths, there were areas of demyelination throughout these nerves (Fig. 7). With higher powered magnification, early disintegration and swelling of the myelin was observed. The

process apparently was too early for marked formation of macrophages. In the Bielschowsky preparation there was breaking down of the axis cylinders; some were swollen and had ball-like terminations; others had a cork-screw appearance. The pathologic process was more advanced in the peripheral nerves of the lower extremities.

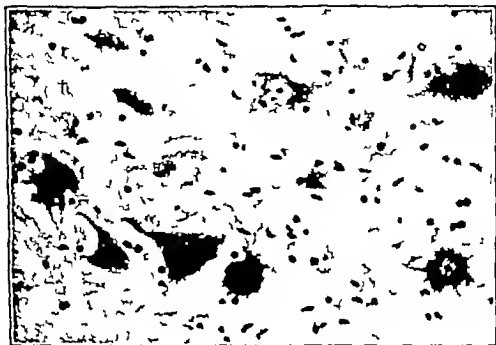


Fig 6—Vacuolization of anterior horn cells. Cresyl Violet stain. $\times 350$

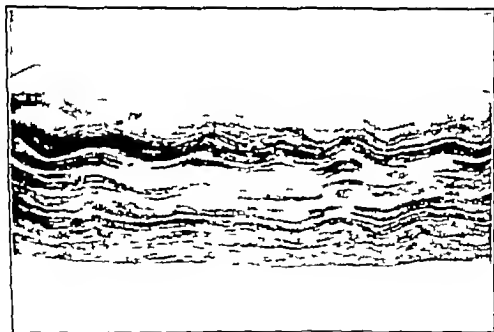


Fig 7—Demyelination and disintegration of the myelin in the peripheral nerve. Myelin sheath stain. $\times 80$

SUMMARY OF CASE

Clinically we are dealing with a typical case of acrodynia. Pathologically the findings of the central nervous system are of great significance. These consisted of swelling of the ganglion cells of the various cortical areas but mainly of the nerve cells of the third cortical lamina.

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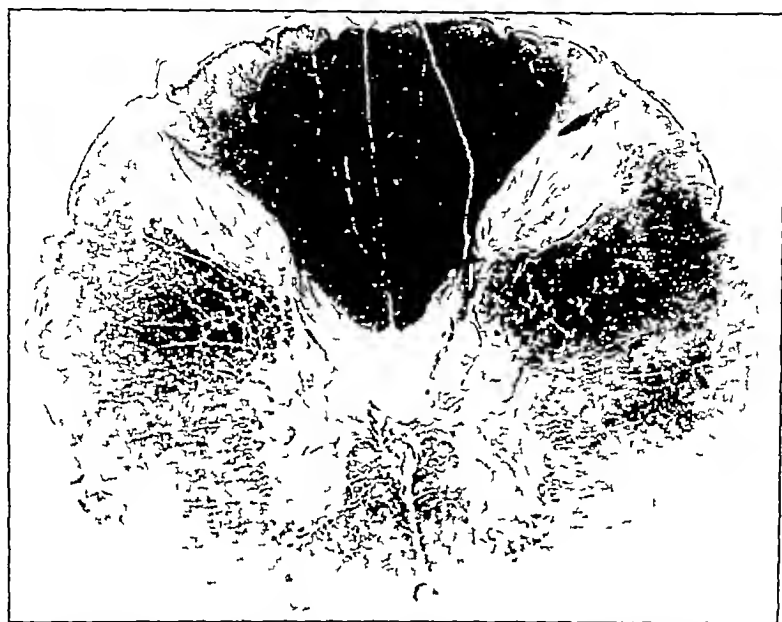


Fig. 4—High cervical region showing marked poverty and paleness in the staining quality of the ventrolateral tracts. The posterior columns are intact. Myelin sheath stain.



Fig. 5—Disintegration of the myelin sheaths in the spinal cord and cerebellar pathways. Myelin sheath stain. $\times 300$.

Peripheral nerves. In the sections stained for myelin sheaths, there were areas of demyelination throughout these nerves (Fig. 7). With higher powered magnification, early disintegration and swelling of the myelin was observed. The

Other observers did not find any changes in the nervous system. Warthin⁷ only found edema of the meninges. He believed that the degenerative changes in the peripheral nerves and the chromatolysis of nerve cells in the brain and cord are postmortem in character. Wyllie and Stern² also believed that the changes described by Kernohan and Kennedy² were not abnormal in the situations mentioned, but the latter, however, insisted that there were definite changes in the mesencephalic root of the fifth nerve and also in the ganglion cells of the thalamus.

The findings in our case are somewhat similar to those described by Kernohan and Kennedy.² Unfortunately in our case the gasserian ganglion and the thoracic and lumbar segments of the spinal cord were not secured at autopsy.

Undoubtedly some of the neural changes in acrodynia, such as the vacuolated cells of the spinal cord and the swollen and chromatolytic cortical and Purkinje cells, may be attributed to the extreme state of starvation or exhaustion. Whether these induced the severe cell alterations of Nissl observed in the nerve cells of the locus ceruleus cannot be answered satisfactorily. The peripheral nerve degenerations can also partially be explained on the above basis. One of us, Davison,⁸ found such changes in some animals which were completely deprived of food. It is also worth mentioning that in the experimental animals, priapism, as noticed in our patient, was not an uncommon finding. As the patient took nourishment poorly the question of exhaustion or starvation should be considered as a causative factor in the pathology of the central nervous system.

The etiology of this obscure disease has not been solved as yet. Paterson and Greenfield¹ think that the polyneuritis is caused by the toxins of some microorganism and not by a metabolic disorder as is postulated in beriberi or pellagra. Acrodynia appears to have occurred more frequently during and after epidemics of influenza and it is usually preceded by an influenzal cold. Byfeld⁴ suggested that the polyneuritis in acrodynia is a form of diphtheric neuritis for he found diphtheroid organisms in the nasal secretion of his cases. He found that the lesion came on shortly after a severe cold and that its course was sometimes considerably shortened by the eradication of septic foci, as the tonsils. Warthin⁷ thought that the picture resembled that of pellagra and on this basis he considered acrodynia as a deficiency disease. Wechsler⁹ and others believe that some cases of obscure peripheral neuritis are not due to toxins or infection, but are the end result of starvation, dietary deficiency—avitaminosis. The similarity of the histopathologic findings in the central nervous system of our case with those found in the dietary deficiencies and starvation would seem to suggest that the latter plays an important role.

CONCLUSION

A case of aerodynia is reported in a child of two years who presented the typical triphasic changes observed in this disease. Histopathologic study of the nervous system revealed a marked swelling of the ganglion cells of the third cortical lamina, the large ganglion cells of the neostriatum, the Purkinje cells of the cerebellum and severe pathologic changes in the nerve cells of the locus ceruleus. In the cervical region of the spinal cord, there was some disintegration of the fibers in the ventrolateral tracts and loss of Nissl substance and vacuolization in the motor cells of the nucleus ventralis of the eleventh nerve, and in the ventrolateral and ventromedial anterior horn cells. The peripheral nerve changes were similar to those seen in peripheral neuritis.

A review of the neural findings in the cases recorded in the literature are too contradictory, and therefore, cannot be accepted as final. Little evidence has been advanced so far to establish the etiology of the disease.

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RICE POLISHINGS AS A SOURCE OF VITAMIN B COMPLEX IN INFANT FEEDING

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THIS study was undertaken to determine the beneficial effects, if any, in infants fed routinely with a food reinforced with rice polish as a source of vitamin B in its complex form.

Vitamin B, once considered a single substance, has been definitely demonstrated to consist of at least two distinct elements: a thermolabile antineuritic vitamin B₁ or B₁₂ and a thermostable antidermatitic vitamin C or B₂.^{1,2}

Recent investigations have indicated the possible existence of many more factors in this complex vitamin, thus raising the question whether or not some of the properties attributed either to vitamin B or C may not be due to other components as yet, not clearly demonstrated.

According to Kruse and McCollum³ sufficient evidence has been adduced to indicate that the physiologic and pathologic effects ascribed to the antineuritic vitamin, at least in growth experiments on rats, are in reality the resultant of a multiple deficiency and are subject to revision as the nature of the B complex is amplified.

If, as Cowgill⁴ feels, a subclinical deficiency of this vitamin exists in this country, then the clinical value of vitamin B is such that it far outweighs, and should not await the scientific discussions and demonstrations of its various factors.

No attempt will be made here to assign any of the conclusions to any one factor, or group of factors, but rather to the whole vitamin as it exists in its complex form. Thus by the term vitamin B will be meant vitamin B complex.

Experimentally it has been demonstrated that vitamin B promotes growth *per se* and by stimulating the appetite.

The effects of a complete deficiency of this vitamin are well known clinically, whereas a partial deficiency has produced according to Hoobler⁵ a symptom complex consisting of anorexia, loss of weight, spasticity of extremities, neck rigidity, restlessness, and fretfulness together with pallor and low percentage of hemoglobin. Anorexia is the outstanding symptom of a vitamin B deficient diet in animals^{7,8} and their food consumption was found to be dependent on the amount of this vitamin in the diet.⁹

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Dried milk used in this experiment was supplied by the Dry Milk Company.

Anorexia is a common complaint of infancy and childhood, and while it is not always attributable to a vitamin B deficiency, nevertheless, the addition of this vitamin has produced excellent results both in the normal¹⁰ and the marasmic type of infant^{11, 12, 13}. Dennett¹⁰ secured good results in infant feeding by the use of a sugar rich in vitamin B and concurred with Hoobler⁶ and Bartlett¹⁴ in attributing anorexia in certain infants to a deficiency of this vitamin. Morgan and Barry¹⁵ describe the beneficial effects of this vitamin both in weight and height increases on malnourished school children, while Summerfeldt¹⁶ obtained similar results on a series of normal children. In view of this, one questions whether the average infant and child is receiving an amount of vitamin B sufficient to produce optimum growth. Sure¹⁷ states that the requirements of vitamin B are greater in the growing young rat, while Supplee¹⁸ and others have shown the growth response in rats to the water-soluble milk vitamin concentrate to be greatly enhanced by the addition of vitamin B as found in rice polish.

While cow's milk in one form or another is the main constituent of the artificially fed infant's diet, many investigators have found not only cow's milk, but also human milk, to be low in this vitamin, especially the antineuritic element^{19, 20, 21, 22, 23}.

With this in mind it was thought desirable to note the effect on normal infants, artificially fed with a milk reinforced with vitamin B in the form of rice polish. In considering a substance rich in vitamin B to be added to an infant's food, care must be taken to see that the substance is such that it does not change the character of the food to which it is added, that it has no disadvantageous effects on the infant taking such food, and that the vitamin B consumption increases parallel to food intake and increase in weight²⁴. Dennett¹⁰ in using wheat-germ sugar as a source of vitamin B found it to be more laxative than other malt sugars, and occasionally so laxative that it necessitated the use of minimal amounts. While yeast may act as a proper supplement in older children, its potency varies considerably, and it is practically impossible to incorporate it in milk without affecting the taste of the milk and at times causing gastrointestinal disturbances.

Rice polishings, which are rich in vitamin B, especially the antineuritic factor, consist of the bran and germ of the rice kernel.

It is possible to prepare and compound with milk, a suitable water extract of rich polishings in a manner which does not affect the taste or keeping qualities of the milk. Furthermore, by employing the active constituents of the rice polishings in this manner, the vitamin B consumption increases parallel to the food intake.

The food used in this series of cases was a 2 per cent fat, irradiated dried milk, to which was added a water extract of crude rice polish. A suitable method for preparing the water extract with a minimum amount of inert material and with a high vitamin B potency was pre-

viously determined by extended experimentation, involving the use of white rats as test animals

Chart 1 was compiled from the average of several groups of experimental animals showing the resulting effect on growth of white rats obtained when the regular dry milk was not fortified with rice polish, in contrast with results obtained when rice polish extracts were incorporated with the milk. The results shown by the check group were obtained when dried milk not fortified with rice polish constituted 10 per cent of the experimental ration, and wherein the milk served as the sole source of all the water soluble vitamins. Groups A, B, and C are similar averages wherein 10 per cent of dried milk fortified with rice polish extracts in small but variable amounts, is included in the basal ration as the sole source of all the water soluble vitamins. These comparative results on experimental animals clearly indicate the improved nutritive

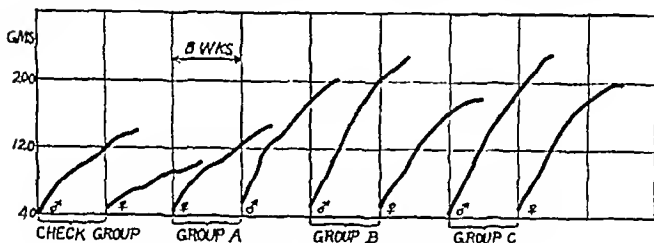


Chart 1.—Weight increase in rats fed dry milk with and without rice polish supplements

quality of the milk fortified with vitamin B in the form of rice polish as contrasted with the same milk unfortified with rice polish

The water extract of crude rice polish is simply made by agitating four parts by weight of water and one part by weight of crude rice polish at a low temperature for a few hours. The resulting infusion then should be freed from excess solids. The solid matter in the final extract has varied from 3.8 per cent to 4.9 per cent. This extract has been added to the 2 per cent fat, irradiated liquid milk and then dried by the roller process. The rice polish solids as carried by the extract have been in the neighborhood of 3.5 to 4 per cent of the total dry mixture. Thus 100 c.c. of the reconstituted, vitamin B fortified, dried milk contains 50 vitamin B units according to Sherman specifications while 100 c.c. of reconstituted dried milk not fortified contains only 25 vitamin B units.

STUDY OF INFANTS

During the past year, one hundred normal infants ranging from new born to six weeks of age were fed this 2 per cent fat irradiated dried

milk, fortified with vitamin B as found in rice polish. No carbohydrates were added to the formula.

They subsisted on this milk for an average period of five months. As controls, without the addition of vitamin B, fifty normal infants were fed the same type of dry milk unfortified, thirty normal infants were fed various modified commercial evaporated milks, and twenty normal infants were placed on modified cow's milk formulas.

The dried milk fortified with rice polish was extremely well borne by these infants. For the first week or two, in some cases, the stools were more frequent and rather loose in character, but this quickly sub-

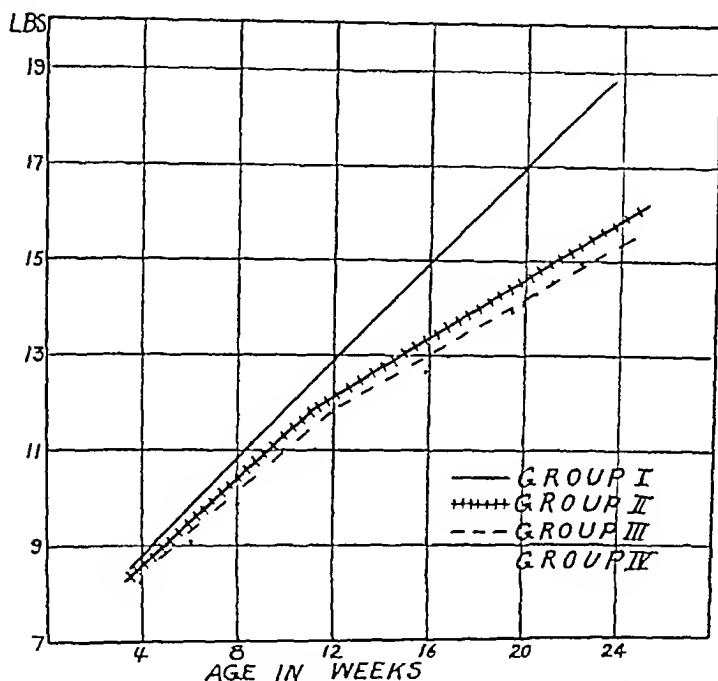


Chart 2—Comparison of the increase in weight of infants. Group I, one hundred infants fed 2 per cent fat, irradiated dry milk fortified with a water extract of rice polish. Group II, fifty infants fed 2 per cent fat irradiated dry milk not fortified with rice polish. Group III, thirty infants fed various modified commercial evaporated milks. Group IV, twenty infants fed modified cow's milk mixtures.

sided without affecting the appetite or gain in weight. From then on, no intestinal disturbances were noted, there being two to three formed stools a day. Constipation was entirely absent in these infants, and on no occasion was catharsis employed.

Chart 2 illustrates the average age in weeks in which the observations were started, the duration, and the gain of weight of these infants.

The great increase in weight of the vitamin B group substantiates Summerfeldt's results with older children. While weight in itself may be a poor standard for determining the effectiveness of vitamin B

in infants, there being many methods of making a child gain, still it is a practical method of recording an infant's well being.

Especially is this true when the weight of the vitamin B group is compared to the group of infants fed the same type of milk without the rice polish. That this increase in weight is not due to an increased caloric intake is demonstrated by the fact that the average daily caloric intake per pound per body weight in the vitamin B group was thirty five as compared with from forty five to fifty five in the other groups. Thus in the vitamin B group there was a greater metabolic efficiency which can only be attributed to an increased intake of vitamin B. No attempt was made to increase the gain in weight by forced feeding, nor were the old standards of caloric requirements adhered to in making up the daily formula. The daily intake of food was increased only when the infant was apparently hungry and showed his willingness to consume more.

Anorexia was entirely lacking in this group, as compared to the other groups in which there were six cases developing about the third month. Muscle tone was better and flesh firmer. The infants were restless, slept better, were mentally more alert and less irritable than is usual. The common colics of infants were absent.

While these observations occurred during the fall and winter months when infants in this climate have less outdoor life, pallor was much less marked in this group. Skin and mucous membranes were free from lesions; there were two cases of eczema and four stomatitis in the other groups. Their physical development was more rapid as evidenced by earlier teething, creeping and walking. Infections were much less common in this group, there being but one case of upper respiratory infection and one of pyelitis. In the other groups there were seven cases of upper respiratory infections complicated in two instances by otitis media, two cases of parenteral diarrhea and one case of pyelitis.

Clinical evidence of rickets was absent in all the infants the irradiated milk acting as the sole antirachitic when fed; the other groups received cod liver oil or viosterol in sufficient dosage.

When cereals and other foods were added to the diet, half of the experimental group was continued on the dried milk fortified with rice polish while the other half was given plain cow's milk. Over a two-month period those on the fortified milk made an average monthly gain of thirty two ounces as compared to an average monthly gain of eighteen ounces of the group receiving cow's milk. Thus, the weight curve is immediately affected by the lowering of the vitamin B content of the food.

Chart 3 illustrates the weight curve of newborn twins fed at various intervals fortified dried milk, and dried milk not fortified with vitamin B. It indicates the possibility that vitamin B influences the weight curve favorably and furthermore, that infants have a low capacity for

tissue storage of vitamin reserve, as indicated by a comparison of the gain in weight of the two cereal groups

Twenty-five abnormal infants subsisted solely on this 2 per cent irradiated dry milk fortified with vitamin B in the form of rice polish. In this abnormal group were placed infants with organic defects and disturbed digestive systems caused by inherent weakness and dietary abuses.

This group included premature infants and infants with mongolism, ectimism, cleft palate, harelip, pyloric stenosis, and pylorospasm. The

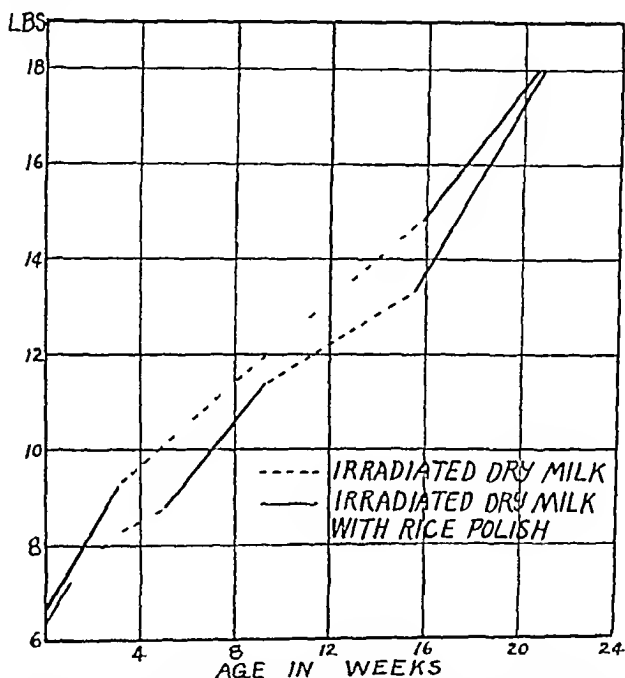


Chart 3—Weight increase of twin infants fed 2 per cent fat irradiated dry milk fortified and unfortified with a water extract of rice polish

average gain in weight for the whole group was five and one half ounces per week over a six-month period. Ten patients were operated upon, five for pyloric stenosis and five for harelip and cleft palate, without any untoward incidence and with unusual maintenance of nutrition.

Vomiting in nine cases classed as pylorospasm subsided rapidly without medication. One infant, six weeks old presenting symptoms—similar to a deficiency of vitamin B according to Hoobler, namely spastic extremities, neck rigidity, weak cry, loss of weight, and anorexia—was placed on the fortified dried milk. Complete alleviation of symptoms occurred in three days, the appetite was markedly improved with resultant gain in weight and loss of spasticity.

SUMMARY

One hundred normal infants were fed a dried milk reinforced with a specially prepared water extract of rice polish as a source of vitamin B for an average period of five months. The increase in weight was influenced favorably, metabolic efficiency was increased, anorexia and gastrointestinal disturbances were lacking, pallor was less marked and nutrition was improved and a greater resistance to infection exhibited. They were, as a group, mentally more alert and less irritable, sleeping better and possessing practically none of the common complaints of infancy, as abdominal colic, constipation, and excessive crying. Infants do not seem capable of storing vitamin B for future use.

CONCLUSION

- 1 The supplementing of cow's milk with vitamin B is desirable for optimum growth in infants artificially fed.
- 2 Rice polishings provide a good source of vitamin B for this purpose.

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ACUTE MENINGITIS DUE TO *BACILLUS FECALIS* *ALCALIGENES*

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THIS gram negative organism, *Bacillus fecalis alcaligenes* recognized first in 1889 has been considered a nonpathogenic organism and has been described as a normal saprophyte in man, having been isolated from blood, stools, and urine of healthy and sick individuals. However, the virulence of this bacillus may in certain cases be increased to such an extent that it becomes a real pathogen capable of producing definite systemic illness. Morbidity resulting from general infections caused by *Bacillus fecalis alcaligenes* is undoubtedly quite low, judging from the scanty literature on the subject.

In those patients with general infections caused by this specific organism the majority have had symptoms resembling typhoid fever,^{1, 7, 8} with an associated bacteremia.^{2, 3} The only pathologic report from this type of case is presented by Ravenel⁴ who describes lesions in the lower ileum and large colon, which appeared to be typical early typhoid ulcers. This patient, a white male, twenty one years old, died on the sixth day of illness. The spleen and mesenteric glands were grossly enlarged and cultures from the spleen and intestinal ulcers showed *Bacillus fecalis alcaligenes*. Recently an epidemic of conjunctivitis⁵ occurred on board a British Naval Training ship and the causative organism when isolated was this same gram-negative bacillus. No systemic symptoms were reported.

The first case of meningitis caused by this organism was recently described by Gatewood.⁶ The patient, a white male child with Jacksonian epilepsy, had a decompression operation, which was followed by symptoms of meningitis. The invading organism proved to be *Bacillus fecalis alcaligenes*, and the meningeal symptoms were relieved by adequate drainage through lumbar puncture. Convalescence was uneventful.

Another patient with acute meningitis in which the invading organism was *Bacillus fecalis alcaligenes* is herewith described.

H. M., a white adolescent female, twelve years old, was first seen October 25, 1930, with a complaint of pain in the lumbosacral region of two days' duration. Her past history was essentially negative. Positive findings on physical examination revealed a healthy adolescent female with a meningocele 6 cm. in diameter in the

lumbosacral region slight atrophy of the right thigh and leg, with pes cavus of the right foot. Roentgenograms showed a spinal fluid occulta involving the upper segment of the sacrum and the third, fourth, and fifth lumbar vertebrae with a beginning spondylolisthesis of the fifth lumbar vertebrae.

Two days later the patient had lessible sign of meningitis. She was hospitalized for a month and during the first two weeks had a stormy illness associated with severe headache, backache, and acute deep muscular pains in the thighs. There were periods of delirium, restlessness, and marked irritability. The temperature varied from normal to 102. F. The leucocyte count varied from 8000 to 11000 with a predominance of neutrophils. The chief therapy aside from symptomatic treatment consisted of adequate drainage of the cerebrospinal fluid through cisterna puncture, twelve such punctures being made during the course of the illness.

The convalescence was uneventful. The child was carefully examined at one week, five weeks, four months, seven months, and twenty months following her discharge from the hospital. At first there was a slight residual papilledema of the optic nerve head but this completely cleared at the time of her last examination. In June 1932, there were no symptoms referable to her acute meningitis.

The laboratory data follow:

CISTERN FLUID

DATE	VOLUME	CELLS	INDEX	PROTEIN (mg/100 cc)	SUGAR (mg/100 cc)	CULTURE	FAHLE	MASTIC
10/21/30	50 c.c.	1.0	+	70	65	Neg	00000-1100	332-111000
10/28	60 c.c.	.370	+			BFA		
10/29	60 c.c.	.300	+	60	6	BFA		
10/30	60 c.c.	.261	+			BFA		
11/ 1	60 c.c.	5.0	+	10	67	Neg	000011-110	222-110000
11/ 2	50 c.c.	800	+			BFA		
11/ 3	60 c.c.	610	+			Neg		
11/ 5	40 c.c.	420	+			Neg	0011237100	344447 100
11/ 7	40 c.c.	220	+			Neg		
11/10	70 c.c.	161	+			Neg		
11/19	45 c.c.	40	-	10	10	Neg	11111-1000	1100000000
12/ 8	70 c.c.	20	-	10	02	Neg	0000000000	00000000 100

Blood culture negative

Stool culture showed none with typhoid dysentery group of organisms

Urine culture showed *Staphylococcus albus*

Blood and spinal fluid Kolmer and Kahn negative

Widal, negative.

Blood serum showed no agglutination with *Bacillus typhosus*, *Bacillus paratyphosus* A, *Bacillus paratyphosus* B, or *Bacillus abortus*

Blood serum showed no agglutination with organism isolated in pure culture from cistern fluid

Agglutination with Flexner dysentery organism in dilution 1:100

No agglutination with Shiga or Hiss Y organisms.

The organism isolated in pure culture from the cerebrospinal fluid of this acutely ill patient was a gram negative motile bacillus producing no acid or gas in dextrose, galactose, levulose, lactose, mannite or maltose. Indol formation was negative. Litmus milk turned alkaline. There was no liquefaction of gelatin.

COMMENT

In classifying the bacteria of the human intestine, Monias⁹ describes a variety of different strains of this organism collected from various investigators, the essential cultural characteristics of which are described above. Evans⁷ recently listed a new subspecies "radicans" which varies only slightly from the organism observed here.

The serology also varies according to various investigators, thus Wyatt³ and Rochaix and Blanchard⁸ observed that their patients' serum agglutinated the isolated organism, while in Evans⁷ patients, as in the one here presented, the organism was not agglutinated by the respective patient's serum. However, there seems to be a uniformity in all the reports as to the negative agglutination with *Bacillus typhosus*, *Bacillus Paratyphosus A*, and *Bacillus Paratyphosus B*.

One clinical feature which was observed by Shearman and Moorehead¹ and by Wyatt³ was the marked pain in the lower extremities. Although the patients described by these writers had a generalized systemic illness, whereas our patient had a definite meningitis, there was, nevertheless, this same marked severe pain in the lower extremities.

SUMMARY

A case of acute meningitis caused by *Bacillus fecalis alcaligenes* is presented, in which a complete recovery was effected by adequate drainage of cerebrospinal fluid through cistern puncture.

The source of the infection could not be found either in the blood, stools, or urine of the patient, and it must be assumed that the causative organism gained access to the cerebrospinal system through a spontaneous opening in the meningeal.

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NEUROCYTOMA OF THE ADRENAL GLAND WITH METASTASIS

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TUMORS of the medullary portion of the adrenal gland are uncommon but are not rare. In a review of cases to 1917, Lehman¹ reported twenty-five cases and made the statement that many more were probably reported as lymphosarcoma and round cell sarcoma. Since then forty cases have been reported, making, with this case, seventy-six in all.

The classification and identification of this group of tumors has been rather confusing as a result of the undifferentiated grouping of the cells. They have been called neuroblastoma, neurocytoma, paraganglioma, and lymphosarcoma. Pathologists are not in agreement as to the exact classification.

The reported cases have usually occurred in children under six years of age, and many of them in children under three years. The symptom complex usually lasts about three months. The onset is usually insidious but may be acute beginning with loss of weight, diarrhea, vomiting, slight rise in temperature, ecchymosis over the eyelids, palpable mass in the abdomen, trauma over the site of the tumor and various metastatic syndromes. The course is progressively downhill with a rapidly increasing anemia.

The gross pathology is distributed over the lymphatic area which drains the adrenal involved. The so-called Hutchinson's tumor with its predominance of metastasis to the long bones, skull, brain, and scalp arises from the left adrenal in the majority of cases, but may arise from the right as in the case reported here. The Pepper type usually arises from the right adrenal and metastasizes to the liver, lung, and pleura. Ewing² gives the anatomy involved in the metastatic process. The tumors may vary in size from a walnut to a small cabbage, they are usually encapsulated. The color of the tumors is usually a pearly white, but they may shade from red to a brownish color. Areas of cystic degeneration are seen throughout the entire mass. The tumor lies free in the peritoneal cavity and does not metastasize by direct extension.

CASE REPORT

W. K., a three-year-old boy of German descent, was brought to the outpatient department of the Jefferson Davis Hospital June 7, 1933, at which time there was pain with swelling on the left side of his face and some fever. On July 8, he returned to the emergency room where a fluctuant mass was opened. The mass

was located over the left mandibular ridge. Following the incision a small amount of pus exuded from the wound. He was referred to the ward on July 13 with a provisional diagnosis of osteomyelitis of the left mandible.

The mother stated that she noticed a small red pimple on the left cheek on June 24 and that about three days later she noticed some swelling of the left jaw. The jaw had continued to enlarge but had not been very painful except when the child opened his mouth. He had been unable to open his mouth for the past week. About two weeks before the swelling on the cheek was noticed the child complained of pain in the left shoulder.

Family History—Negative for chronic, familial, or hereditary diseases.

Past History—The baby was full term, delivery was normal. There were no convulsions, cyanosis, or paralysis noted. He was breast fed for the first three months, then bottle fed. The diet was prescribed by the mother. The child had always been a precocious eater.

Physical Examination—On admission to the ward, the examination revealed a poorly nourished, yellowish, pasty, toxic white male lying quietly in bed. Over the mesial portion of the left frontal bone was a bluish tumor, slightly painful on palpation. It was firm and connected with the periosteum. There was a slight proptosis of both eyes. The lid of the left eye showed ecchymosis. The mouth showed a necrotic mass, with a foul odor and a serosanguineous discharge, attached to the left cheek, and extending from the angle of the mandible to the second molar. It seemed to be attached to the mandible and to the mucous membrane of the cheek. Pain was produced when the patient opened his mouth. The left side of the face showed a large swelling, which was not painful. The mass was white and shiny, and the superficial veins were dilated. The tumor extended from the outer canthus of the left eye to the fourth cervical vertebrae. It could not be separated from the mandible. The salivary glands could be easily identified. The left posterior and anterior cervical glands were enlarged. A systolic murmur was present over the left second, right second, and left fifth interspaces. The murmur, not transmitted, had a soft blowing quality. The heart extended from the second interspace superiorly to the fourth interspace on the left side 8 cm. from the left border of the sternum. The right border was continuous with that border of the sternum. The abdomen was prominent with distended veins. The liver was palpable, soft, and smooth. It extended four fingerbreadths below the costal margin. The extremities were emaciated but not atrophic. The blood counts revealed a progressive anemia, which did not respond to any of the methods of treatment used. The urinalysis on several occasions showed mucous and hyaline casts. A blood culture taken on two different occasions showed no growth at the end of six days. The Wassermann and Mantoux tests were negative. The reticulocyte count was steadily increasing up to the time of death. Smears from the mouth taken on admission revealed Vincent's spirilla and fusiform bacilli. The blood chemistry was nonprotein nitrogen, 62.15, urea, 30, sugar, 133.33, and creatinin, 1. Two weeks later the blood chemistry was nonprotein nitrogen, 27.5, urea, 12.5, sugar, 103.2, and creatinin, 1.3. The x-ray reports are grouped at the end.

A diagnosis of neurocytoma of the adrenal gland with metastasis was made on July 14. The tumor mass increased steadily in size. On July 26, a mass was palpable in the right renal region. The tumor was incised the same day and the necrotic tissue removed. At this time it was considered an osteomyelitis of the left mandible. On August 1, the tumor over the frontal area was opened and a reddish piece of tissue removed. The surgeon considered this as a metastasis from an osteomyelitis of the left mandible. On August 12, the patient developed semicoma with the Jacksonian type of convulsions of the left side. This was relieved by glucose. The patient died, August 17, in a state of semicoma and convulsions.

History of Intoxication (Dr. HARRY E. BRUNN).—The body was that of a poorly nourished well-developed white male. The skin was pale and jaundiced. A mass was present over the left mandible, left frontal bone near the midline, right parietal bone and superior to the globe of both orbits. The mass over the left mandible and left frontal areas revealed old operative wounds.

The abdomen revealed a large tumor in the right renal area. It was evanescent maroon in color, and soft. It was not attached to the kidney, but began in the region of the right adrenal gland. The mass extended across the abdomen and was 20 cm. long and 1 cm. in breadth. There was no metastasis to any other organs of the abdominal cavity. The glands of the iliac region were enlarged. The thorax revealed a tumor in the sixth and seventh ribs on the left side. It was maroon in color and soft. A mass extending from the left side of the sixth cervical vertebrae to the second thoracic vertebrae was also found. All of the axillary, inguinal, cervical, iliac and the right popliteal glands were enlarged. All enlarged glands and cutaneous growths revealed the same type of tumors grossly. All of the long bones revealed pathologic fractures at the superior epiphysis, and the same type of tumor was found grossly. These metastatic tumors were growing in the marrow and had produced a great deal of de-



Fig. 1.—Cyst of left mandible. Destruction of angle of left mandible with a malignant cyst anterior to the first sacification.

struction. A mass was present in the right parietal region in the dura over the left frontal lobe in the cerebellum near the pons and over the great wing of the sphenoid. These masses were the same grossly as the ones already described. The kidneys were large, granular and pale. The liver and spleen showed some congestion. The heart and lungs were negative. The anatomic diagnosis was right adrenal cell tumor with metastasis to the skull, vertebral long bones, mandible, brain ribs and lymph nodes—subacute parenchymatous nephritis.

Microscopic examination.—Sections of the tumors consisted of small cells with deeply stained nuclei. The cells were packed in groups with orderly arrangement; rosettes were present. There were circular aggregates of cells which showed mitotic figures. The cells lay in a fine granular matrix. The fibrillae could not be demonstrated. The microscopic diagnosis was neuroblastoma, subacute parenchymatous nephritis, cloudy swelling of the liver, spleen and heart. A section from one of the metastatic growths revealed the same type of tumor.

X-ray studies.—On July 17 a plate of the left mandible revealed destruction of the angle with a cyst in the region of the third molar. Two days later a lateral plate of the frontal area showed periosteal thickenings and striations. On July 21 a plate of the femurs and humeri showed feathering of the epiphyseal ends. On



Fig 2—Further destruction of tibia and femur at epiphyseal ends

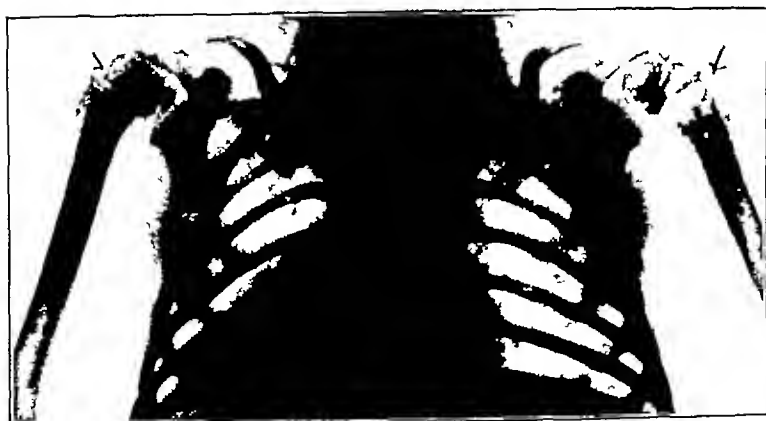


Fig 3—Pathologic fractures of proximal epiphyses of the humeri with marked destruction



Fig 4.—Metastasis to left side of frontal bone showing feathering of the periosteum.



Fig 5.—Gross specimen of tumor

August 9 a lateral plate of the frontal bone revealed an osteogenetic process with new bone formation. A plate of the humeri at the same date revealed marked destruction of the proximal epiphyseal ends. At this date a dentigerous cyst of the right mandible in the region of the third molar was described. On August 10 plates of the long bones revealed fractures of the proximal ends, with marked destruction.

COMMENT

This case is presented because of the interesting features, the variation in the metastasis of a tumor from the right adrenal is worthy of report. The involvement of all of the long bones with fractures is of interest.

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828 MEDICAL ARTS BUILDING

Pediatric Clinics

THE CHILDREN'S MEMORIAL HOSPITAL, CHICAGO

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CUSHING has aptly said: "Hospitals have personalities." The chief aim of this series of special articles, as I take it, is to portray the personality, the individuality, of each clinic or hospital described. Because of its isolation as a self-centered and independent institution the Children's Memorial Hospital lends itself peculiarly to this approach. The name of the Hospital itself conveys one important phase of its personality. With one exception, all of the buildings devoted to the cure of children and to the housing of the resident and nursing staff have been erected as memorials. This in itself constitutes a background of human interest and sentiment of which those interested in its conduct cannot be unmindful. Originally established as a charitable institution it has remained almost wholly so throughout its fifty years of existence. In 1920 provisions were made for the admission of private patients as well in one wing of the newly erected Martha Wilson Memorial Pavilion. The chief interest in this departure lay in providing for concentration of the work of the medical staff in one place rather than in an added source of income. About 60 per cent of the operating expenses of the Hospital are met with income from endowments, largely from bequests. The balance is almost wholly supplied by general or special requests, by annual contributions of those interested in the Hospital by the proceeds from a Rummage Shop and in the last two years by contributions from welfare and relief agencies. Last year less than 10 per cent was received from all patients and only about 0.5 per cent from the out patient clinic and ward patients. The Hospital has been able to weather the economic depression with only minor curtailment of some service and of salaries in spite of an enormous increase of attendance in the Out Patient Department.

The general direction of the Hospital is vested in a Board of Trustees of seventeen members. The Board of Trustees appoints annually the medical staff, the Superintendent, the Directress of the Training School and a Women's Auxiliary Board of some forty six members, who are responsible for the internal administrative management of the Hospital. In order to effect a closer and more prompt cooperation between the various agencies that take part in the conduct of the Hospital the following committees have been established, each to meet once a month:

1. The Superintendent, the Chief of Staff, the Directress of the Training School, and two other members of the medical staff appointed by the Chief.
2. The Superintendent, the Chief of Staff, the Medical Director of the Out Patient Department, and the Head of the Social Service and Nursing Staff of the Out Patient Department.
3. The President of the Board of Trustees, the Superintendent, the Chief of Staff, the President of the Women's Auxiliary Board, and two other members of the Board of Trustees appointed by the President. Other members of the staff are asked to attend these meetings as seems desirable.

Seven of the eight buildings that constitute the Hospital are arranged on the pavilion plan around the periphery of a roughly triangular grass plot of four acres, facing chiefly on Fullerton Avenue, but also on Orchard Street and Lincoln Avenue, about three miles distant from the downtown section of the city. North of Fullerton Avenue stood the original Maurice Porter Memorial Hospital of thirty beds, founded in 1884 by Mrs. Julia F. Porter in memory of her son, Maurice Porter. The growth and development of the Hospital can best be followed from this point on by a description of each new building in chronologic order and by references to the accompanying illustration taken from about the middle of the Hospital grounds.

The Maurice Porter Memorial Pavilion, the two story building with solarium, near the center, was donated by Mrs. Julia F. Porter in 1908. The first floor has thirty-two beds for orthopedic patients, the second floor a like number of beds for patients with rheumatism and its complications and sequelae, and nephritis.

Cribside Pavilion, the smaller two story building on the extreme right, was donated by the Cribside Society of the Hospital in 1908. It has thirty beds for medical and surgical patients under eighteen months of age. The lower floor is divided into cubicles and is used exclusively for infants with infections. The upper floor is reserved for those free from infection. The diet kitchen for infants is in the semibasement.

On the extreme left is the Agnes Wilson Memorial Pavilion donated by Mr. John P. Wilson, Sr., in 1912. Originally occupied by wards, it was remodeled in 1926 to accommodate the growing Out Patient Department. In the semibasement are the record room for the whole Hospital, the x-ray laboratories, the drug room, and isolation and hospital admitting rooms. The first floor contains the main Out Patient Department admitting room, the social service quarters, two preparation and waiting rooms, and three examining rooms, all exclusively for babies. On the second floor is a secondary receiving room, a preparation room, and eleven examining rooms. The third floor contains the chemical, bacteriologic, clinicopathologic and Otho S. A. Sprague Memorial Institute laboratories, the morgue and autopsy rooms, a museum, and a large room for photography and basal metabolism determinations. On the roof is a penthouse for animals with outdoor runways. Immediately next to this building is the one and two story building with twenty beds for patients with contagious diseases arising in the Hospital. The semibasement is used by the Psychiatric and Speech Correction Departments. Between, and connecting, the two buildings is a clinical amphitheater seating about sixty-five.

The Martha Wilson Memorial Pavilion, the larger five story and semibasement building shown on the far right of the illustration, was completed in 1926 "under the provisions of the will of Martha Wilson and out of the proceeds of her residuary estate." It was a part of her vision, characteristically expressed in this manner, that provisions for private patients should be made, with the main thought in mind that it would accrue to the benefit of the volunteer staff of the Hospital as well as to that of the Hospital itself. The basement contains the general and special kitchens, the library, the central supply room, store rooms, etc. The main portion of the building faces Fullerton Avenue and from this a wing extends along Orchard Street. On the first floor the main portion houses the administration and the nursing staff, the wing, waiting and admitting rooms and doctors' rooms. The second floor has in the main portion thirty-one beds for medical patients and in the wing eight rooms devoted to a Health Service and Infirmary for temporary illnesses of the nursing and interne staff. The third floor has a like arrangement with thirty-three beds for surgical patients in the main portion and eight private rooms for the use of the staff and any other accredited

physician. On the fourth floor are two operating rooms, sixteen beds for tonsil and adenoid patients and nine beds for oral surgery. In the wing of this floor are twenty beds in two and four bed private ward for the exclusive use of the attending staff. On the roof are accommodations in two large and two small rooms for twelve boys and twelve girls with a large open space in each wing into which the beds can be wheeled. The patients are largely subacute or chronic cases transferred from the medical, surgical and orthopedic floors. There is also a large play room and a therapeutic tank.

In 1911 the original Hospital building on the north of Fullerton Avenue was torn down, and on an enlarged site the nurses and internes' seven story residences were completed and occupied. These buildings were erected in memory of Nellie A. Black and Jane Deering, respectively. Accommodations are provided in these buildings for 112 nurses and twenty-one internes and residents. The nurses' home contains an auditorium seating 300. It is connected with the other buildings by a tunnel. With the completion of these buildings the original nurses' home at the apex of the triangle was remodeled and is now occupied by the help. The only other building is a large power and light plant and laundry.



View of part of the Children's Memorial Hospital from the middle of the Hospital grounds. The buildings from left to right are the Contagious Pavilion and Out Patient Department (Agnes Wilson Memorial), the Maurice Porter Memorial Pavilion for orthopedic, cardiac, and nephritic patients, the Martha Wilson Memorial Pavilion for older medical and surgical, and private patients, and the Cribble Pavilion for infants under eighteen months of age.

to the left of the contagious building on Lincoln Avenue. This was erected in 1911 with funds made available by contributions of friends of the Hospital.

The university affiliation and teaching activities of the Hospital are rather unique. Toward the close of the year 1910 an agreement was reached between the University of Chicago and the Children's Memorial Hospital for affiliation of the Hospital with the University. This does not mean that there has been in any sense or to any degree a merger of the Hospital in the University. In the preamble of the agreement it is expressly stated that the provisions of the contract are the basis of affiliation and cooperation under which relations between said two corporations shall be entered into and maintained, each corporation expressly retaining and maintaining its several responsibilities and sole and separate obligations with respect to the carrying out of the purposes for which it has been organized. This agreement is terminable at the election of either party upon one year's notice.

The original purpose was "to make the Children's Memorial Hospital a center for postgraduate work in the study and treatment of diseases of children. Delay in completion of the University Clinics in distance

of ten miles between the two institutions, and other considerations have made the affiliation nominal rather than active. Postgraduate work, in the usual sense, has been restricted to one or two annual courses of one month each for practitioners. In a very real sense the staff feel that their most important postgraduate interest and activity center in the interne and resident staff. Since 1931, without formal affiliation of any kind, the Hospital has furnished clinical instruction to seniors and juniors of the nearby Northwestern University Medical School. Two amphitheater clinics a week are conducted each quarter, one for juniors and one for seniors, each class numbering from twenty to twenty five. Throughout the year from eight to ten seniors attend the Out Patient Department clinics daily for one month, and two or three clerks are assigned to the wards for a like period.

Since 1920 the medical and surgical staff have been made up of a Chief of Staff, or medical director, a few part time members, and a much larger number whose service is voluntary. In 1930 the Chief was placed on a practically full time basis, except for the privilege of doing a limited amount of private practice. All members of the staff are appointed annually. The Chief, upon notification of his reappointment, recommends to the Trustees of the University of Chicago all of the medical and surgical staff for the ensuing year. After they have been acted upon by the Trustees of the University, they are in turn acted upon by the trustees of the Hospital. The attending staff consists of about ninety members distributed as follows: fifty pediatricians, three neurologists, one dermatologist, seven general surgeons, three orthopedic surgeons, three oral surgeons, two neural surgeons, two urologists, eight otolaryngologists, one endoscopist, four ophthalmologists, one pathologist, one roentgenologist, one speech corrector, two dentists, and one resident director of the Otho S. A. Sprague Memorial Institute. In addition to the last five enumerated there are also part time directors of the Out Patient Department and of the Hospital Health Service.

The resident staff consists of two medical residents, one in the wards and one in the Out Patient Department, a surgical resident, and a resident in pathology, the latter maintained by the Sprague Institute. There are eleven internes who rotate through all services including the Out Patient Department and the surgical specialties. The deficiency of a newborn service is in part met by a service at the nearby St. Joseph's Hospital. No apology is offered for a rotating service since all work with children is of about equal pediatric interest and importance. A preceding year of a rotating internship is required of internes and an additional year of pediatric work of residents. The internes do all of the ordinary routine laboratory work. The resident in pathology performs all necropsies and conducts the weekly pathologic conference. There are about 175 necropsies a year. The usual attendance at the conferences is about forty. Particular emphasis is laid on correlation of the clinical, roentgenologic, and gross pathologic findings at these conferences.

The Children's Memorial Hospital is primarily a clinical institution, and stresses that phase of pediatrics. This is a part of its personality, and follows to some extent from the nature of its organization, its isolation, and its material. The staff, attending and resident, feel that the care and study of sick children and their own clinical development are fundamental to all pediatric activity. Research, and especially that of the laboratory, is not featured to the extent that it is in some clinics and is not encouraged in those who show no initiative or interest in that phase of pediatrics. To those who do, every opportunity, encouragement and stimulation is given. Because of the nature of the organization and the rather ample material, investigation is chiefly along clinical lines. The

Otto S. A. Sprague Memorial Institute under the general direction of Dr. H. Gideon Wells has been an important factor in the research activities of the Hospital for over twenty years.

Perhaps an outstanding phase of the Hospital's personality is its activity on the part of the Out Patient Department work. Nearly 50 per cent of the staff does some work in the Out Patient Department. Nearly all of the internes and residents consider it the most valuable part of their hospital experience. It is treated as of at least equal importance in every respect with the rest of the Hospital. The two activities are so interwoven that there is no sharp line of cleavage. The Out Patient Department is a part of the daily round. The Hospital with 261 beds has had for some years about the same average daily occupancy, somewhere around 150. The annual out patient visits on the other hand have increased in the last six years from 7,072 to 20,010. While this increase especially in the last two years is in part due to the prolonged economic depression this is largely neutralized by the strenuous effort of clinicians and especially of the social service unit to limit attendance along geographic and other lines. Every effort is made to cooperate with outside physicians and whenever possible to refer patients to their own physicians both at the beginning and at the end of their attendance in the clinic. A careful social and financial history of each patient is obtained as a basis for admission or rejection from the clinic. Our present physical equipment is not adapted to the care of well babies and all such are referred to Infant Welfare Station who in turn consult with, and refer sick babies to the clinic. A very efficient social service and nursing staff plays an indispensable part in the conduct of the clinic. Nearly every larger special clinic has its own social service worker. A large corps of volunteer workers contributes to the work of the clinic by weighing and preparing patients especially babies for examination by bringing patients to the clinic and by serving as writers for clinicians.

ATTENDANCE AT SPECIAL OUTPATIENT DEPARTMENT CLINICS IN 1933

DEPARTMENT	PATIENTS IN CLINICS	VISITS TO CLINICS
Infant Clinic	2,118	5,377
Medical Clinic	11,040	23,543
Quartz Light Clinic	11	63
Urology Clinic	23	788
Cardiac Clinic	41	2,025
Neuropsychiatric Clinic	500	2,332
Surgical Clinic	2,880	8,103
Orthopedic Clinic	928	4,879
Dermatology Clinic	634	1,688
Ear Nose and Throat Clinic	2,901	6,773
Eye Clinic	2,511	7,447
Syphilitic Clinic	593	2,940
Speech Clinic	103	932
Sprague Laboratory	262	386
Asthma Clinic	250	2,479
Oral Surgery Clinic	114	367
Diabetic Clinic	24	247
X-ray Treatments	27	60
Patients registered in clinic for 1933	Total	18,580
Visits made to clinics in 1933	Total	70,510
Number of free visits to clinic in 1933	Total	52,418
Number of deaf interviews in 1933	Total	27,397

By "free visit" is meant that the patient cannot pay twenty five cents

Special clinics are conducted in the usual subjects, and by the same clinician, both in the Out Patient Department and in the wards. The nature of these and the attendance, as shown in the following table, may be of interest.

What has seemed to us an interesting feature has been the low occupancy of our infant wards as compared with that of many other hospitals. For reasons that are probably patent to every pediatrician it is our aim to keep out, rather than to admit, all babies that can be cared for reasonably well or better outside of the wards. In a general way this policy applies also to older children unless they are of unusual clinical interest. With provision for thirty babies in Cribside Pavilion our average occupancy is around 50 per cent and sometimes falls to 25 per cent. Only about 9 per cent of the total occupancy of the Hospital comes from infants under eighteen months of age. Having no interest in per capita cost, in full wards per se, or in the dubious pedagogic value to the interne and resident and nurse of mass experience in morbidity and mortality in an infant ward, this is as we want it. The efficient service of the Infant Welfare Society, and of our own Out Patient Department is possibly an important factor in being able to bring about this result with a definitely lessened morbidity and mortality rate. There are doubtless climatic, social, and other factors that enter into the picture, but they are not evident on the surface. There is no convalescent home service available to the Hospital for the care of babies and only to a limited extent for older children. Our interest in recent years has steadily increased in an apparently safer, better, and cheaper foster home convalescent care for both babies and older children.

Critical Review

INFECTION AND IMMUNITY

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INTRODUCTION

THE subjects of infections and immunity have become so involved that it will be necessary to review cursorily their more fundamental principles in order to understand properly the conceptions that are mentioned in the medical literature. It is equally obvious that one must have an understanding of the many terms used to describe these ideas. For convenience, I will discuss the topic under the following heads:

- I Infection
- II Immunity
- III Hypersensitivity as a Result of Passive Immunity
- IV The Application of Principles of Infection and Immunity to Specific Diseases

These topics shall be considered only as they apply to man as a host, though we may utilize knowledge derived from correlated and other species for purposes of illustration. The subject matter may be found covered in detail in any of the textbooks by Karsner and Lickor,¹ Zinsser,² and Kolmer.³

I INFECTION

We have progressed a little from the days when our progenitors argued as to whether diseases were caused by mechanistic or vitalistic actions or were the result of fermentation or of spontaneous generation, miasmatic factors, etc. to the conception of today that infection is the result of metabolic processes of organisms that utilize the living tissue of a host for their growth and survival.

It is fundamental at the onset to appreciate the difference between contamination and infection. A thing may be grossly contaminated with organisms and yet no infection be present. On the other hand infection may occur with contamination. In a general way persistent contamination may sometimes bring about an increase in resistance against the specific contaminating organism. It is impossible to be dogmatic as to what is and what is not contamination in certain parts of the body. For example the presence of diphtheria organisms in the throat does not necessarily mean a diphtheritic infection. At times, these organisms may be merely leading a saprophytic existence in individuals who have previously had the disease or they may be contaminants, but subminimally parasitic enough gradually to build up an immunity in the host, even though the individual may be seemingly free from demonstrable infection.

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The sequence of infections may be important. An organism may be the primary or secondary cause of a disease process, the latter really being a complication of the first. For example, the mortality rate for whooping cough is very high, yet when one analyzes the reasons for the cause of death in this disease, it is found that secondary bronchopneumonia accounts for the greatest percentage of the high mortality rate. Multiple secondary infections may occur that are totally unrelated to a primary infection, and it is obvious that in a series of infections, the terminal one is usually the cause of death. Such terminal infections if primary might not be fatal.

Infections may be epidemic or endemic in character and peculiar to well demarcated localities or general in their spread.

Some organisms will produce specific local reactions in the host. Others will be specifically local in their growth, but because of their metabolic activity, cause remote symptoms in the host. Some of the latter are called focal infections. On the other hand, some infections may involve all the organs of the body, irrespective of the original focus or portal of entry, and if the host has no protection or immunity the damage may be massive and the issue quickly decided. These infections are called fulminating or malignant. Children of the civilized world do not die as a result of measles per se, but because of the secondary infection of bronchopneumonia. The fulminating type of measles occurs rarely save in races that have never been previously exposed to the infection. One must never forget that some of the more usual diseases to which we have become accustomed are apt to evince malignant manifestations in virgin soil. It must be remembered likewise that diseases which for years have been mild in character may suddenly become malignant.

The human host through long years of exposure had adapted itself so that the entodermic and ectodermic coverings of the body prevent the ingress of the ordinary bacteria that could attack the vital hidden parts beneath. A break in the host's defense mechanism will provide an entrance through which organisms may come in contact with tissues not prepared to meet the onslaught of the invader. Streptococci on the skin are harmless to the host. Streptococci in the corium or subcutaneous tissue mean an infection with organisms that are usually destroyed *in situ* if the patient is to recover. It is important to know the portal through which an organism gains access to the undefended tissue since symptoms usually begin there as a part of a clinical syndrome. Certain diseases have a regular or usual portal of entry. It is quite true that diphtheria bacilli may lodge anywhere in the human host and cause infection, but the usual infection occurs in the upper respiratory passages. If we know the portal of entry, we usually know the site where the host first complains of symptoms, and we can sometimes guess the genus of the offending organisms.

As a result of infection, several conditions may develop, dependent upon the patient's resistance. The offending organisms may multiply to the extent that they enter the blood stream, bacteremia will then develop. The disease may cause such an increase in the white cells of the blood elements that abscesses and pyemia will result. The organisms may shunt their metabolic products into the blood stream to be carried everywhere, resulting in a toxemic condition in the host. An individual's resistance may be so lowered by one infection that ordinary saprophytic organisms may actually multiply in the blood stream and sapremia be found, finally the bacteria may multiply to such an extent

that with their toxins, a condition of septicemia may be noted. The terms, toxemia septicemia moribund and septic are not such as to lend themselves well to actual definition. Word pictures and all the adjectives at one's command do not convey to a person who has never seen such a case the correct impression as to just exactly what is meant by these terms. We recognize these conditions only after we have seen the clinical entity.

After the onset of an infection in the host, a train of events follows which is often predictable since it may have a definite pattern peculiar to the particular organism that has caused the infection.

Infection itself may be broadly defined as the result which is brought about in the host by the metabolic processes of an organism or as the derangement in the host, either local or general, that results when organisms have passed through a portal of entry in the host and have gained access to susceptible tissue.

Though organisms may break through a portal of entry, their spread depends upon their virulence and the susceptibility of the host. The former could be roughly defined as its disease producing power which under various conditions may be enhanced or modified as will be noted in subsequent paragraphs.

Bacteria must have a favorable tissue in which to multiply before they can become dangerous. Some sites in the host are peculiar in that they are inherently antagonistic and tend to limit the growth of certain organisms to a relatively innocuous saprophytic existence. The presence of the colon bacillus in the large intestine is unimportant from an infective standpoint; in fact, its presence is almost a necessity to the host from the point of view of metabolism. On the other hand when this organism locates elsewhere it becomes parasitic and can cause disease as it does in pyelitis.

The virulence of an organism may not be lessened but because it is implanted on a site unfavorable for its particular growth it may not be able to cause disease whereas it is just as true that the soil upon which an organism lives may be so favorable as to enhance its growth and often its virulence. Vincent's organisms, really facultative anaerobes, do not grow well on the skin or, ordinarily, in the vascular muscular tissue since the latter is well oxygenated but they will grow luxuriantly in crypts of the tonsils and in areas between the teeth and gums where oxygen may be excluded. This point is nicely illustrated when Vincent's angina attacks the tonsils. These glands may be entirely destroyed by the infection but the disease usually stops when the infection reaches the capsule and the muscular tissues beneath the gland irrespective of the type or kind of treatment, chiefly because of the fact that the organisms have reached an unfavorable place for their multiplication.

Some species may be susceptible to organisms that do not infect other species. For example, the human being is extremely susceptible to infection by the streptococci while chickens are not. Such information is chiefly important from an experimental and epidemiologic standpoint.

Marked differences appear in the same classes of bacteria that cause infection. There are smooth and rough strains of virulent bacteria so called because of the way they grow on artificial media. The smooth strain is usually more virulent and pathogenic while the rough is often avirulent and nonpathogenic. Some disease irritants are so small that they can pass through finely graduated filters. Such entities are called viruses.

In the growth of an organism, just as in the growth of any living thing, multiplication depends upon the presence or absence of light, moisture, carbon, nitrogen, oxygen, certain salts and denatured proteins or certain particular elements such as hemoglobin, etc., as the case may be. Although all of these enumerated factors necessary for growth may be present, still these organisms may die because of the unfavorable temperature at which incubation occurs.

The number of bacteria that gain access to the host at any one time is important in the consideration of any infection. Broadly speaking, immunity to disease is merely that protection which prevents an individual from contracting the infection under the ordinary circumstances of exposure. Irrespective of protection, disease may come about when the host is exposed to massive doses of organisms, though the inherited or acquired protection may be sufficient to modify the severity of the disease attack.

By far the most important characteristic of an organism from a disease-producing standpoint is its capability of defending itself against the opposing factors of the host. It is obvious that if the organisms cannot live and multiply at the expense of the host, they cannot produce disease. One must remember this fact when considering all of the forces brought into play by the organisms to overwhelm the defense of the host.

Even though an organism may be virulent, it depends in great measure for its growth upon a favorable host. A host that is unfavorable may be made experimentally favorable. The frog, a thermolabile species, will not be affected by anthrax in its natural state, but, if its temperature is raised to or above that of the human, it may be infected.

There are certain organs of the body in which bacteria may multiply better than in others, in other words, there is manifested a specific susceptibility on the part of an organ. It is also true that there are organs which have a heightened specific resistance against certain bacteria.

Although the organisms may gain access to the host or reach a susceptible organ in such numbers as would ordinarily cause a disease, they must have time to multiply in these favorable areas before the alterations that are produced in the host are recognized as disease. An undisturbed incubation period, then, of a relatively shorter or longer time is an absolute essential in order to enable the organisms to produce the disease in the host. It may take a long while to bring about typhoid fever. On the other hand, the organism that causes scarlet fever may multiply sufficiently to cause the disease within from 24 to 48 hours.

Although many organisms are able to produce disease by mere extension and multiplication in the tissues of the host, there are peculiarities about the metabolic activities of some organisms that make them distinctive. Certain bacteria produce poisons, some of which are contained within the cells and are only released at the death of the bacteria. These are called endotoxins. Others produce poisons or toxins while still living in the host. This type of poison is called extracellular, or an exotoxin, or it is described as a true soluble toxin. Often the bacteria themselves, as is the case with diphtheria, do not cause any essential harm and were it not for the extracellular toxins produced by the organisms, they would be relatively innocuous. Often the endotoxic or exotoxic poisons or themselves have peculiarly specific qualities. They may have the property of cytotoxicity, that is, they are capable of dissolv-

ing the cells of the host hemolysis and cause lysis of the red cells leucocidins and kill the leucocyte cell, hemagglutinins and agglutinate the red cells, aggressins and paralyze the protecting agency in the cell body, as a consequence of which the host is overwhelmed virulins and inhibit phagocytosis. (The evidence as to the presence of the latter two entities is debatable since both poisons might very well fall under the general head of endotoxins or exotoxins.)

Bacteria may often cause metabolic changes by fermentative reactions. The disease condition in the human is due not always to the organism or its endo- or exotoxin products. Sometimes the metabolic reactions that result after the cells of the host have absorbed the dead bacterial proteins are sufficient to disturb the balance of normality and produce a disease picture. Some of the poisonous products of bacteria are common enough to receive specific names such as staphylococcal toxin, diphtheria toxin, streptococcal toxin, tetanus toxin, botulinus toxin, etc. Phytotoxins and zootoxins are evolved by a higher order of species than bacteria and are not considered in this review.

II IMMUNITY

For a long time there were two schools of thought as to how immunity was produced. Metchnikoff hypothesized that protection and subsequent immunity were brought about by the action of the cells of the host. The other school with Flügge held that protection was a humoral thing, the result chiefly of fluid tissue changes. At present it is obvious that immunity and the protection that follows are effected by both cellular and humoral reactions with the aid of many other processes about which little or nothing is known.

The cellulist stated that when organisms passed the portal of entry the leucocytes or lymphocytes were brought to this area as a result of some chemotactic influence, the result perhaps of osmosis or diffusion. The white cells (leucocytes) were massed as an army at the site of the infection. They engulfed the bacteria which they sometimes killed outright by themselves or with the aid of enzymes contained in the leucocytes and sometimes they merely incarcerated the organisms for the time being. In the latter case if the white cells were later destroyed the bacteria would be set free and could again begin multiplying. Metchnikoff thought that an individual was immune to an infection if he possessed leucocytes in the tissues that functioned, and that the acquisition of immunity was accomplished by training the leucocytes to perform more ably what he considered their natural function. If the leucocytes were not destroyed the macroblasts might engulf them together with all the local debris. These large wandering cells may actually prevent the death of an animal after the injection of virulent organisms. Whether they come from fixed tissue cells or are white cells which have become differentiated need not bother us in this review. Though the question is not settled the contention today seems to be that they are part and parcel of the reticulo-endothelial system. No matter by what name they are called—histocyte, clasmatoocyte, giant cell, fixed tissue cell, etc.—their major function in an infection seems to be that described by Metchnikoff as peculiar to the macrophage.

A rabbit injected intrapleurally with a mixture of streptococci and broth will die. If a broth mixture is injected into the pleura, there is a local increase in clasmatoocytes. If a fatal dose of streptococci is given intrapleurally two days after broth has been injected, the animal will

survive When peptone broth applications are placed on the abdomens of guinea pigs, clasmatoocytes are found increased in the subcutaneous area When staphylococci are injected locally in doses that are usually fatal, the animal may develop nothing more than a localized inflammatory response The controls may die, even though the number of small white cells found about the local lesions in their skins is legion These defensive cells of the blood are protean in their avidity for foreign particles

Many of the local immunities seem to be nonspecific in type

When infection occurs, another type of immunity, the humoral, may be perfected This is evidenced by the presence of so called antibodies in the bodily fluids, of precipitins which precipitate the antigen, agglutinins which clump the organisms, bacteriocidal elements, bacteriolytic antibodies which dissolve the bacteria, lysins, enzymes, cytases which dissolve cell walls, antihemolysins, substances which prevent solution of the blood cells, antifeiments, tropins which exist in immune serum and aid phagocytosis by acting on the bacteria, particularly antitoxins which neutralize the toxins, and antitryptic elements which, in general, hamper or completely inhibit bacterial growth

As was stated before, immunity is brought about by a combination of forces, both humoral and cellular Which type of immune principle would be most involved in a particular disease depends upon the character of the invading organism The antitryptic elements present in normal serum may hamper, kill, or have no defense against an organism In the latter instance, the battle for recovery is left to the phagocytes, and the bacteria involved are termed serophytic since they grow in normal serum Staphylococcus, streptococcus, and pneumococcus are good examples of such organisms Other organisms may not be killed, but are hindered in multiplying so that phagocytosis may not be hampered If the serum of such a patient loses its antitryptic character, the efficiency of the phagocytes may be lessened It can be seen then that immunity is actually a combination of forces, cellular, humoral, etc, so that when one element is neutralized, the other elements are apt to be lessened in their efficiency

The exact spot where the humoral antibodies are manufactured is usually unknown, but it may be selective or organ in type, for example, the skin, the gastrointestinal tract, etc Thus it may be local and strictly confined to one place, or it may be general and the entire body concerned in its production

Protection of the host against the invading organisms or their products is helped by immunity The latter term could be defined as that inherent something which an individual possesses that protects him from attacks of disease In general, immunity may be natural or acquired If acquired naturally, it may be a characteristic something possessed by a species, as we have seen with frogs that are not susceptible to anthrax, or it may be a racial immunity or a lack of immunity A racial lack of immunity to tuberculosis exists among members of the Negro race It may be a familial immunity which tends to protect whole families against infection, or it may be individual in character, whereby certain members of a family may have more protection against infection than others of the same family, or it may be inherited from the mother, as it is in measles Species immunity is interesting simply from an experimental standpoint, and of the other types of natural immunity, the in-

herited is the only one of practical importance. Inherited immunity is merely relative since such immunity can be broken down if the numerical number of invading organisms or infecting units that attack the host are more than sufficient to neutralize the antibodies present.

The acquisition of immunity may be natural occurring as a result of an attack of a disease. If the host survives the original attack there are usually no further infections of the same character. The search for methods of artificially developing immunity forms the basis for practically all advances in immunology and for much of the experimental work done in medicine for the past fifty years. All immunization programs have as their object the production of qualities in the susceptibles which neutralize, precipitate, or destroy the bacteria or its poisonous substances.

Artificial immunity in the host may be acquired either actively or passively. Many people confuse these terms. Active artificial immunity is acquired by a susceptible person after he has in some way been given a modified attack of the disease. Passive immunity artificially acquired on the other hand is a temporary immunity conferred upon an individual who already has the disease in an attempt to neutralize the effects of the acute infection. The serums or antitoxins used to develop this type of immunity (passive) are obtained from persons or animals that have recovered from the same infection or from animals that have been actively immunized against the infection. Passive types of immunity are fleeting in character and merely tide the patient over a crisis.

There are four methods of acquiring active artificial immunity. One is by the injection of the very material that causes the infection. Thus the Chinese did when they protected against smallpox by practicing variolation. By this procedure, some of the pus from a pustule was taken from an individual who had a mild attack of smallpox and inoculated into susceptible persons in the hope that the latter would get mild attacks of the disease. One can easily surmise that since the virulence of the virus and the susceptibility of the host were unknown factors the results were unpredictable, and that many times the individuals whom they tried to protect died from the very disease that resulted from the attempted immunization. One should not confuse variolation with the present method of vaccine virus vaccination for the former method of acquiring artificial immunity has been forbidden by the laws of all civilized countries since the middle of the last century.

Another method of artificially acquiring immunity is by the injection of attenuated living organisms, virus, etc. Pasteur found that when the germs of fowl cholera remained on the shelf in his laboratory for three months or so they lost much of their pathogenicity but retained their antigenic value and their capabilities for producing immunity. As a result of this experience many advances in medicine were made possible.

A third method of artificially protecting humans is by injecting the killed bacteria that cause the disease, the best illustration of which is seen in the use of typhoid vaccine. The fourth method is to inject small amounts of the bacterial poisons that cause the disease. This is done in protecting against diphtheria.

Specific serums, convalescent serums, or antitoxins are used to give artificial passive immunity to the sick patient. It may be repeated that such injections only protect temporarily if at all. A person ill with

TABLE I

DISEASE	CONTAGIOUS INDEX FOR HUMAN BEINGS	SPREAD BY DIRECT OR INDIRECT CONTACT WITH ITU MAN BEINGS	NATURAL IMMUNITY		METHOD OF ACQUIRING	ARTIFICIAL IMMUNITY		PASSIVE ARTIFICIAL IMMUNITY		SPECIFIC TESTS FOR SUSCEPTIBILITY
			PRESENT BEFORE DISEASE ATTACK	ACQUIRED AFTER ATTACK		SUCCESS	DURATION	TYPE FOR ACUTE ATTACKS	SUCCESS	
Anthrax	variable	both	none	yes	vaccine	variable	variable	anthrax serum	poor	none
Chickenpox	high	both	none	yes	no method	(-)	(-)	none	(-)	none
Cholera	high	both	none	yes	vaccine	dubious	questionable	cholera serum	poor	none
Diphtheria	low	usually direct	Inherited slight	yes	Antitoxin or toxoid	excellent	8 yr + ?	diph anti toxin	good	Schick
Encephalitis	low	probably direct	?	?	no method	(-)	(-)	conval serum	?	none
Erysipelas	low	questionable	none	none	no method	(-)	(-)	ery antitoxin	questionable	none
Glanders	low	probably direct	none	yes?	no method	(-)	(-)	none	(-)	Mallein test
Leprosy	low	probably direct	?	probably none	no method	(-)	(-)	none	(-)	none
Measles	high	both	Inherited lasts 4-6 mo	yes	no method	(-)	(-)	conval serum	good	none
Measles—German	moderate	probably direct	same	yes	no method	(-)	(-)	none	(-)	none
Meningitis epidemic	low	direct	individual	same	no method	(-)	(-)	meningitis serum	fair only	none
Mumps	moderate	direct	none	yes	no method	(-)	(-)	none	(-)	none

TABLE I—CONT'D

DISEASE	CONTAGIOUS INDEX FOR HUMAN BEINGS	SPREAD BY DIRECT OR INDIRECT CONTACT WITH HUMAN BEINGS	NATURAL IMMUNITY		METHOD OF ACQUIRING	ARTIFICIAL IMMUNITY		PASSIVE ARTIFICIAL IMMUNITY		SPECIFIC TESTS FOR AFFIRMABILITY
			PRESENT BEFORE DISEASE ATTACK	ACQUIRED AFTER DISEASE ATTACK		SUCCESS	DURATION	TYPE FOR ACUTE ATTACK	SUCCESS	
Plague	high	both	none	yes	Haffkine's vaccine	variable	variable	anti plague serum	poor	none
Poliomyelitis	low	unknown	individual	yes	none	none	(-)	convalescent serum	poor	none
Rabies	variable	direct	probable none	yes?	Pasteur's treatment	good	questionable	none	(-)	none
Scarlatina	35-65%	both	inherited lasts 4-6 mo	yes	Dick toxin	good	1 yr?	of antitoxin	questionable	Dick
Smallpox	high	both	none	yes	vaccination	excellent	2 yr?	convalescent serum	(-)	none
Tetanus	variable	direct	inherited slight	?	tetanus (Lark)	good	questionable	tetanus anti toxin	good	none
Tonsillitis—acute strep	high	both	individual slight	none?	vaccine mixed	variable	one season	strep serum	poor	none
Trench fever	high	indirect (house)	none	none	no method	(-)	(-)	none	(-)	none
Typhoid	moderate	both	individual slight	good	typhoid vaccine	excellent	2 yr	typhoid serum	poor	none
Vincent's angina	low	direct	?	none	no method	(-)	(-)	none	(-)	none
Whooping cough	moderate	chiefly direct	none	yes	pertussis vaccine	variable	?	convalescent serum	questionable	none

diphtheria who has been given diphtheria antitoxin may again contract the disease within a few weeks after a previous attack

IN HYPERSENSITIVITY AS A RESULT OF PASSIVE IMMUNITY

The subject of hypersensitivity has acquired some importance because of the common use of therapeutic antitoxins, serums, etc. An individual treated with an antitoxin may react to the proteins contained in a therapeutic serum and is then said to show hypersensitivity.

A person's hypersensitiveness may be inherently natural, and he may be entirely ignorant of his sensitiveness until after the injection of a foreign serum when the reaction makes the condition obvious. On the other hand, the sensitivity may be acquired and the patient may have been made sensitive by the previous injection of a foreign protein, like serum. In this case, the history is of value.

After serum injection, the hypersensitive individual may have all grades of reaction from ordinary serum sickness to the most severe type of "anaphylactic shock." The latter term is usually reserved to describe persons who have been previously sensitized and who subsequently receive an injection of the sensitizing agent, after which shock and even sudden death may follow. Since this type of reaction occurs so rarely, one need not worry much about it.

Hypersensitivity in man is usually evidenced by a reaction to the therapeutic agent, which may be either immediate, accelerated, or normal in type. Patients who have immediate reactions may have one symptom or a combination of symptoms such as high fever, tachycardia, urticaria, joint pains, chills, vomiting, cyanosis, etc., all coming on within a time from a few minutes to a few hours after the therapeutic injection. The person who has an accelerated reaction will have the same type of symptoms, appearing later, however, approximately from 4 or 5 hours to 24 hours after the injection of the therapeutic agent. The delayed reaction is the usual type of serum sickness seen and appears from seven to eight days or more after the therapeutic injection. There are signs other than the rash which may indicate serum sickness, such as pain in the mesenteric glands, generalized glandular enlargement, arthritis, etc.

Sensitivity is determined by skin testing with a small amount of the therapeutic antigen. This is done either by scratching the skin, by the intradermal injection of the antitoxin or serum, or by the so called ophthalmic test. It is my experience, after either making thousands of tests myself or having them done under my supervision in the contagious wards, that skin testing has no value in determining sensitivity to the various serums. My experience during the past two years has led me to conclude that the ophthalmic test is also of no practical value. We have found that there are just as many individuals who are positive skin test reactors and evince no evidence of hypersensitivity as there are individuals who are negative reactors and have serum sickness after the injection of the therapeutic antitoxin. I have come to the conclusion that we need not fear the therapeutic use of serums or antitoxins when administered intramuscularly and that skin tests are interesting experimentally, but they are worthless as far as practicability is concerned.

Attempts have been made to desensitize individuals who are hypersensitive by injecting increasing doses of the antigen (in this case, the therapeutic serum or antitoxin). The size of the initial dose depends upon whether the injection is to be intradermal, intramuscular, or intra-

venous. If desensitization is done intradermally more antigen can be employed than if the serum were injected intravenously. Desensitization is invaluable in experimental work with animals but in my experience it is worthless when applied to the human. In this connection I wish to stress that I am not speaking of pollen antigens etc. but only of therapeutic antitoxins and serums. We have had as many and more severe reactions in positive skin test reactors who were desensitized as we have in those who were not desensitized after the therapeutic antigen.

For the past fourteen years a careful record has been kept at the Contagious Division of Cleveland City Hospital of the clinical reactions that followed the use of every tube of diphtheria and tetanus antitoxin and meningitis serum and for the past few years records have been kept on every tube of scarlet fever and erysipelas antitoxin that was used on our wards. The patients still have serum sickness, though to a comparatively less extent, after the use of erysipelas antitoxin whether the material has been super refined or not and we have reverted to our clinical practice of ten years ago and now pay little or no attention either to skin sensitivity or to desensitization.

IV APPLICATION OF PRINCIPLES OF INFECTION AND IMMUNITY TO SPECIFIC DISEASES

We will now consider the practical aspects of some of the contagious diseases. The acute infectious diseases the mycotic infections, etc., are to be reviewed by another writer. Such unusual things as psittacosis rat bite fever, etc., need not be discussed.

In referring to the diseases we have selected the points to be considered will be as follows: the degree of susceptibility or the contagious index in humans, whether the spread of the infection is by direct or indirect contact, whether the human has any natural immunity because of race inheritance etc. whether immunity is acquired as the result of a disease attack the particular method of acquiring active artificial immunity and its success the length of time this lasts if it is successful whether the serums of individuals who have the disease contain antibodies or whether the serums of animals who have been artificially actively immunized contain protective antibodies that could be utilized in passive immunity whether normal homologous human serum could be utilized and whether there is a method for testing out the presence or absence of immunity in the humans.

In Table I where the above outline is not complete, it shall be taken for granted that the points in question are obscure.

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American Academy of Pediatrics

Proceedings

THIRD ANNUAL MEETING OF THE AMERICAN ACADEMY OF PEDIATRICS

MONDAY AFTERNOON SESSION
JUNE 12, 1933

Round Table Conference on Epidemic Meningitis

Leader Dr John A Toomey, Cleveland, Ohio Assistants Dr Albert J Bell, Cincinnati, Ohio, and Dr Edward B Shaw, San Francisco, Calif

The meeting was called to order in Room 191 of the Edgewater Beach Hotel at 2 P M by the Chairman, Dr John A. Toomey

Dr Albert J Bell opened the session by remarks on the "Bacteriology, Immunology, and Complications of Meningitis"

After the late war it might have been expected that there would be a very favorable condition for a world wide spread of this disease, but this was not the case, save in one or two countries of which I will speak in a moment

This (referring to Chart 1) represents the Union of Socialist Soviet Republics The number of cases occurring, twelve thousand, is the largest number reported This chart is from the Health Report of the Secretariat of the League of Nations, Geneva, March to April, 1932

The second line represents the United States where the number of cases did not start to increase until 1926, reaching the peak in 1929

England and Wales showed their initial rise in number of cases a year later, 1927, and reached the peak in 1931

All other countries, except Germany and Japan, reached their peaks in 1929, 1930, or 1931 In Germany, as you see, the rise started in 1921 and reached the peak in 1922 Japan's increase started in 1923 and reached the peak in 1924

France did not seem to show anything spectacular

Chart 2 illustrates the trend of the morbidity of cerebrospinal meningitis in the United States from 1917 to 1931 This is also from the Health Division of the Secretariat of the League of Nations

Epidemics occurred between 1917 and 1929 The disease was endemic all the time, but very sporadic in character In 1929, we had our peak, and the morbidity curve decreased rapidly to 1931, as shown in the chart I understand it was very much lower in 1932

This map in the center gives a graphic distribution of the cases per hundred thousand of population

In the shaded zones we see the greatest number of cases in Tennessee and Arizona. The next greatest proportion is in Indiana, Missouri, Alabama, North Dakota,

and Wyoming. Next in number of cases are the New England states and North Carolina. The epidemic skipped South Carolina and Georgia and caught Ohio, West Virginia, Virginia, Minnesota, Montana and Nevada. Washington and California are also in this small group.

Kentucky, South Carolina, Texas and Oregon have few or no cases.

I think this map shows clearly the apparent purposeless scattering of case distribution.

The table from Metcalf illustrated the actual morbidity rates. The greatest number of cases occur in the infant and young child group as compared to the relatively smaller number occurring in adult life. Any number of cases of epidemic meningitis is too many, but when one considers the whole population the actual number of cases is very small. This I have added to Dr. Metcalf's chart (indicated lower part of chart) as showing the difference between the number of clinical cases which occurred and the number of people (carriers) who harbor the meningococcus in the nasopharynx. Conditions may arise to bring the carrier rate to as high as 70 per cent. Thirty-five per cent was not uncommon in army contingents. In civil life the carrier rate may be 3 per cent.

Epidemic Meningitis (Bacteriology Immunology Complications)

Albert J. Bell, M.D., Cincinnati, Ohio

Bacteriology—Causative organism: the *Diplococcus intracellularis* of Weisbussbaum.

Other names—the meningococcus *Diplococcus intracellularis meningitidis* etc. and more modernly the *Neisseria meningitidis* because of a certain similarity with other gram negative organisms culturally, serologically, and morphologically such as the gonococcus, enteric bacilli and flava.

Prior to 1909 meningococcus meningitis was thought to be caused by a single strain of the meningococcus. In 1909 Dozier discovered the parameningococcus differentiated from the meningococcus by immunologic reactions and especially by the agglutination reaction.

In 1915 Gordon and Murray classified all meningococci into four groups by means of agglutination tests. According to Flexner the Gordon Type 1 appears to correspond with the parameningococcus of Dozier and Type 2 with the normal or regular meningococcus. Types 3 and 4 appear to conform to the more common intermediates. In Nichol's classification, his Type A corresponds to Gordon's Types 1 and 3 and his Type B to Gordon's Types 2 and 4.

Since then this grouping has generally held, and progress has consisted in finding more and more strains and attempting to correlate them with the four groups previously mentioned. Norton and Broom¹ in the Detroit epidemic isolated ninety-five strains, sixty-two of which were obtained in pure culture from spinal fluids and thirty-three of which were of nasopharyngeal origin from case contacts, and were assigned to Group 3.

It was known prior to 1923 that the differentiation of these organisms depends upon their relation to the fermentations of sugars, agglutination, and complement fixation. Subsequent work has been in the main a refinement of details and technique.

A summary of the findings of Williams and Goeling,² Bureau of Laboratories, Department of Health, New York City, will be instructive.

1 In cases of purulent meningitis, stained spreads are helpful, but they are unreliable for demonstrating the causal organism, that is, cultures are the only

¹McCoy, George W. Epidemic Meningitis, Association for Research in Mental and Nervous Diseases, Vol. XII of a Series of Research Publications.

reliable method In tuberculous meningitis, on the contrary, by following strictly a special technic in preparing the spread, a large percentage of trustworthy results have been obtained

2 Adequate cultural methods made early in the disease have been shown to demonstrate rapidly and accurately the causal organism in the great majority of cases

3 By these methods it has been found that the meningococcus is no more difficult to isolate than other organisms, and it is a comparatively easy matter to grow the tubercle bacillus

4 The slide agglutination test can be relied upon to identify the meningococcus as well as certain other bacteria

5 The keeping of preliminary cultures for more than seventy two hours has resulted in isolating interesting and unusual organisms

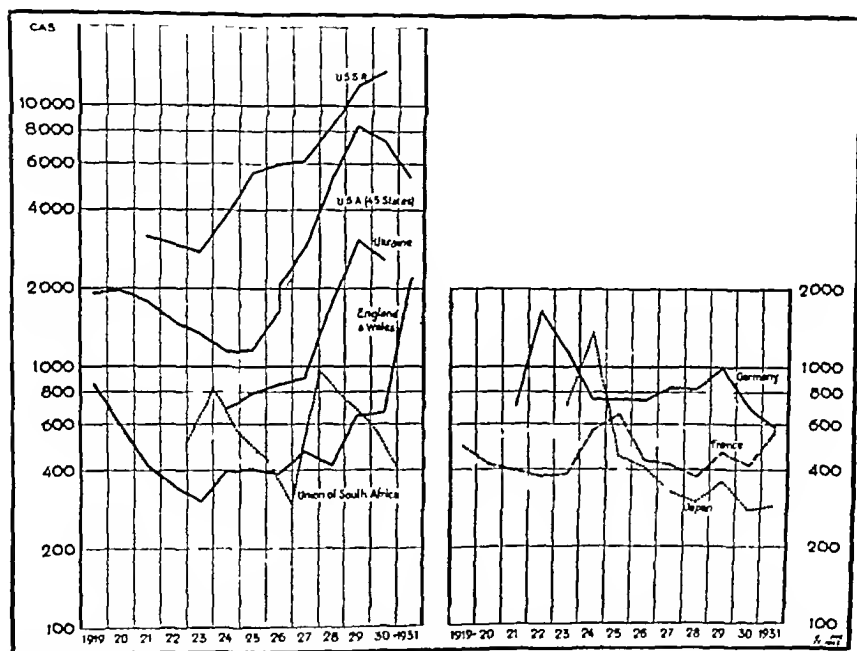


Chart 1—Evolution of cerebrospinal meningitis (cases reported) in various countries of the world from 1919 to 1932 (Modified.)

According to Kohlbry,³ the organism in the spinal fluid may be intra or extra cellular, according to whether the disease is mild or severe. He has found that the best culture medium is dextrose semisolid agar as prepared by Gosling. Identity of the organism may be proved by agglutination and fermentation tests.

Haslor⁴ found the slide agglutination method more satisfactory than a fermentation test.

The technic for differentiating the many organisms found in the spinal fluid and nasopharynx must of necessity be omitted in this review.

Epidemiology—Epidemic meningitis or cerebrospinal fever was recognized as an entity in 1805 when it was described by Vieusseux in Geneva, Switzerland, and McCoy⁵ speculates on whether or not it had been previously overlooked, or if this was its first appearance. Sir William Osler thought it was and expressed his views

dramatically to the effect that "In cerebrospinal fever we may be witnessing the struggle of a new disease to win a place among the great epidemics of the world." Since then it has appeared in nearly every part of the world.

A scourge to armies, epidemics may occur at long and irregular intervals, even twenty years and may require several years to pass over a country. Sporadic cases occur yearly and their source is purely a matter of conjecture; the tracing of the source of epidemics is sometimes difficult or impossible.

The geographical distribution is not helpful as it is well known that it may jump from one country to another which is quite remote.

The line of travel is difficult to trace. In New York City in 1901 and 1902 a severe epidemic occurred while Philadelphia remained free from cases.

Let us trace as briefly as possible the world movements of epidemic meningitis for the past fifteen years as reported by the Health Section of the International League of Nations.

After the World War, when resistance might be expected to be at its lowest, the influence of the disease decreased in Western Europe until 1922 and 1923. Germany was the exception, reaching its peak in 1922 with 1,500 cases. Since then many countries—Austria, Belgium, Italy, Poland, etc., went progressively upward and reached their maxima in 1929. Similarly the United States, England, Scotland, and the Netherlands attained their high points two years later, that is, in 1931.

The United States has paralleled England, that is, a decrease after the World War until 1921, then a progressive increase, the morbidity rate was 9 per 100,000 as opposed to 0.4 in 1917.

The peak of the last epidemic wave in the United States reached the Rocky Mountain and the Pacific states, the New England states and north central states (1929), sooner than the south central and south Atlantic states (1930).

The fallowing off of the disease was especially noticeable in Rocky Mountain and Pacific states and still more so in the United States as a whole in 1930.

It is a disease of winter and spring but cases may occur during the summer.

Race has not been considered a factor although in the recent war and in the Detroit epidemic the mortality rates were twice as high among the negroes in comparison with the white population.

Males are more often attacked than females in the proportion of 1½ to 1. This is probably due to more frequent opportunities for exposure.

TABLE FROM MCCOY

MORBIDITY RATE OF MENINGITIS PER 100,000 PERSONS IN INDIANAPOLIS, DETROIT AND NEW YORK

AGE GROUPS	INDIANAPOLIS	DETROIT	NEW YORK
Under 1 year	281	158	101
1 to 2 years	188	160	59
5 to 9 years	106	10	35
10 to 19 years	87	51	17
20 years and over	33	10	8

Carriers Under normal conditions 2 to 5 per cent (Glover)°

Under crowded conditions, number may rise above 70 per cent.

Thirty-five per cent out uncommon in American cantonments (Rosenau)

In civilian population, noncontacts may be positive up to 35 per cent

The age of the individual is significant as shown in McCoy's morbidity table for Indianapolis, Detroit, and New York. In this we have seen that the greatest incidence was under one year less so but still high under one year, and noticeably diminished beyond this. As opposed to this when the population affected

reliable method. In tuberculous meningitis, on the contrary, by following strictly a special technic in preparing the spread, a large percentage of trustworthy results have been obtained.

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3 By these methods it has been found that the meningococcus is no more difficult to isolate than other organisms, and it is a comparatively easy matter to grow the tubercle bacillus

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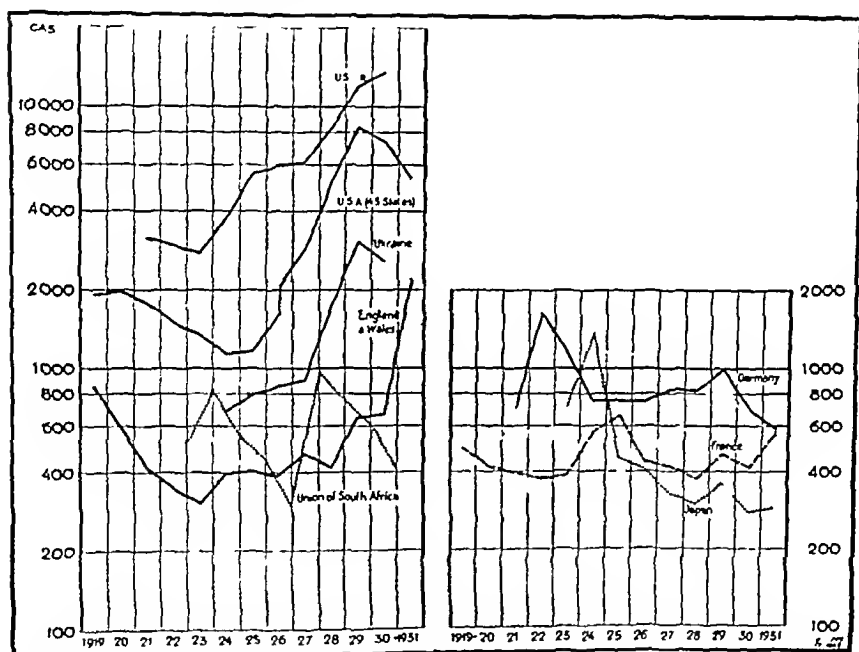


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is composed of older age groups as in cantonments the attack rate may be quite high, even higher than that of a definite age group in the general population.

So far as is known, none of the lower animals are carriers of this disease, man alone harbors the organism.

Vaughan says there is no doubt but that the meningococcus is carried into the body by inspired air although it may reach the nasopharynx through the mouth by means of food and drink.

The physical condition plays an important part in predisposition to this disease and there is general agreement that overcrowding in some way plays a prominent role.

Although infection with the meningococcus or rather its presence in the nasopharynx, is widespread, clinical cases are rare in comparison with other communicable diseases according to Herdick.⁷ In the majority of instances infection fails to progress to a frank attack that is while there is but slight susceptibility to the organism, the mortality of the disease is high about 50 per cent. Expressed in other words the death rate is high in comparison with the attack rate.

Usually only one in a family is attacked, and contacts rarely develop the disease. In the Detroit epidemic more than one case occurred in twenty three out of 692 houses, 3.3 per cent. There is an absence of outbreaks in schools.

The number of deaths was a trifle less than the average number of deaths from diphtheria during recent years and about the same as measles. The significance of the statement lies in the comparison between the number of cases of meningitis and those of the other two diseases, this in spite of fairly widespread use of serum. The Surgeon General's office shows 1,777 deaths out of 4,612 cases. In the Detroit epidemic, 1928 and 1929, Norton and Gordon¹⁰ report the fatality rate in infants under one year as 81 per cent. In persons over 20 years this rate reached 64 per cent.

The carrier problem is an interesting and important one. In 1901 Albrecht and Gohs first recognized carriers of the meningococcus. Murray⁸ classifies carriers into primary or 'contact' and 'noncontact' and secondary or convalescent. Glover⁹ considers a high carrier rate that is 20 per cent as a warning of an impending epidemic. Figures for the case-contact rate (carriers) may be found as high as 50 to 70 per cent while an attack rate of one per thousand is rare. The carrier rate of noncontact-cases may be 6 per cent.

In endemic conditions the case mortality is much lower than during epidemics when the fulminating types more often occur according to Gordon and Norton.¹⁰

Infection begins as a nasopharyngitis and may be limited there. Ordinarily it invades the blood, where it may also be confined or eventually reach the meninges.

The association of epidemic meningitis with poliomyelitis, epidemic encephalitis, and influenza has not been proved to be significant, as reported by Peters and Gunn.¹¹

Serologically, different strains of the organism appear to be active in different epidemics or they are not the same in epidemic or intermediate periods.

Complications.—The Eye.—Purulent conjunctivitis with abundant meningococci in the exudate may occur. It resembles gonococcal conjunctivitis, but it is not so painful usually does not invade the cornea destructively and responds promptly to treatment, according to Herdick.¹²

Corneal ulceration may be a complication.

Panophthalmitis may occur in from 2 to 5 per cent of the cases in the very severe types of the disease. While ordinarily only one eye is affected, both may be involved, and the outlook, as far as vision is concerned, is hopeless. Sympathetic ophthalmia never occurs but the eye is a source of pain and toxemia, and enucleation is indicated.

In hydrocephalus, amaurosis may be observed and is of serious import. If it is caused by edema vision may be restored. Advanced optic neuritis or atrophy is rare.

The Ear—Otitis media of meningococcal origin may form a part of the process, and inflammation may invade destructively both middle and internal ear

The Heart—Myocardial degenerations are rarely ever seen.

Pericarditis may be present, either fibrinous or purulent in type, those with exudate being relieved by local serum treatment

Dilatation of the heart, the occurrence of murmurs, and a positive blood culture may assure one of the presence of endocarditis

The blood pressure is low during the septicemic stage in serious types of infection and is of grave import. With the onset of meningeal involvement, according to Farley and Stewart,¹³ the arterial tension usually rises, and cases in which this exceeds 120 mm. of mercury are more fatal than cases without elevation.

Internal hydrocephalus is usually accompanied by elevated blood pressure, but with the release of pressure, the blood pressure may either rise or fall. Sophian¹⁴ has shown that a fall in blood pressure usually follows the intraspinal administration of serum.

Arthritis—Three types have been recorded

The first, an acute polyarthritis occurring at the onset of the disease, resembles acute rheumatic fever by involving symmetrical joints with local pain, swelling, and redness. It is probably due to hemorrhage into the synovial membranes and is usually transitory

The second type occurs late and involves one joint, usually the knee, which becomes red and tender. The exudate is seropurulent in character and contains meningococci in about 50 per cent of the cases. The duration of this condition is long, but the prognosis is good.

The third type of arthritis is an arthralgia due to serum therapy

Internal Hydrocephalus, Subarachnoid Block.—Continuing to quote from Herick,¹² "The ventricular system and subarachnoid spaces form a series of channels through which the cerebrospinal fluid circulates from its principal point of origin in the choroid plexus to its principal point of absorption in the great venous sinuses. The system of channels may be blocked in any one of a number of places, most commonly about the roof of the fourth ventricle encroaching upon the foramina of Magendie and Luschka. Next in frequency the aqueduct of Sylvius is occluded."

Heightened intracranial pressure results in various pathologic changes in the brain.

Internal hydrocephalus may be acute or chronic

Block is indicated when only a few drops of cerebrospinal fluid are seen during puncture or when it is thick, together with clinical signs of intracranial pressure

Relapses, etc., according to Leake,¹⁵ seldom occur after complete convalescence. "There is no case on record of a second attack of meningitis due to a different type of meningococcus than that which caused the original attack."

Metastatic foci during septicemia may complicate the picture. In some epidemics, epididymitis is seen.

Serum Reaction—Aside from the characteristic syndrome with which we are familiar, there may be meningeal reaction lasting about twelve hours, that is, even an increase in the amount of the purulent spinal fluid

Mixed Infections—Councilman, Mallory, and Wright report one case in which the tubercle bacillus was seen together with the meningococcus. Nattier, Salamer, Mathews, and Fitzgerald report five cases in which the pneumococcus was superimposed upon cerebrospinal fever

Cerebral Hemorrhage—Montgomery¹⁶ reported a case with the following explanation. Subependymal inflammatory lesions accompanied by necrosis are not uncommon in cerebrospinal meningitis. The necrosis of adjacent tissues in conjunction with a sclerotic artery caused it to rupture into the lateral ventricle

Lewis¹⁷ mentions among additional eye conditions, the occurrence of iridochor

oiditis in an appreciable number of cases, papillitis in three cases, and blindness without visible lesions in two cases.

Cisterna Magna Tap or Syndrome—Several cases are reported by Reuben and Chasnoff¹⁸ and their comments are as follows:

In meningitis a syndrome (rapid pulse, rapid respiration, high or low temperature, occasionally delirium) which is probably due to pressure upon the medulla and pons by distended cisternae may develop. When this is true a cisternal tap causes immediate improvement of the symptom. No serum is introduced after the first tap regardless of the character of the fluid. On return of symptoms, after a second tap is performed, if the fluid has been found to be pathogenic (organisms, etc.), half as much serum as the amount of fluid withdrawn should be introduced and this procedure is carried out even if the fluid can be removed by means of spinal puncture.

Certain features stand out prominently in a review of this character:

1. The manner of the spread of epidemic meningitis, which is without apparent reason and with no demonstrable or satisfactory explanation. In this respect it is similar to poliomyelitis.

2. The widespread presence of the meningococcus in the nasopharynx of healthy persons.

3. In contrast to this, the small number of clinical cases compared with other communicable diseases.

4. The high mortality rate, reported in some cases as high as 50 or 60 per cent and, as Oster has said, "comparable only to cholera or the plague," this in spite of the fairly general use of serum. This may be due

- a. to an unusually virulent organism in certain epidemics;
- b. to an organism of different type from that in the serum used; or
- c. to late recognition of the disease.

The hopelessness of treating or isolating all carriers is apparent. It is important, however, for the nasopharynx of as many persons that is, likely contacts as possible to be examined with appropriate treatment in view, also that a study be made of the organism obtained from the throats of clinical cases with reference to a serum which would be applicable to a given epidemic.

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DISCUSSION

DR SHAW—Dr Bell referred to one thing which has, in particular, engaged my interest. This is the simultaneous infection of the meninges by the meningococcus and some other organism, the case cited being one in which tubercle bacilli were present in the spinal fluid along with meningococci. In a small series of meningitis cases, I have seen three in which tubercle bacilli accompanied meningococci in the fluid, the former being demonstrable by smear, guinea pig inoculation, and autopsy findings and the latter being demonstrable by smear and culture. It seems surprising that such coincident infections should occur commonly, but I believe an explanation may lie in the effect of meningococcus toxins on the blood vessel walls. No other mode of pathogenesis seems to explain satisfactorily how, from a minute original focus, meningococci are carried into the blood stream in a profusion which exceeds any other bacterial sepsis and, with almost equal ease, pass out of the circulation at the site of final localization. The fact that other organisms may, from an accessible inflammatory focus, be carried through the blood stream along with the meningococci seems to me to emphasize the significance of the toxic vascular damage which accompanies the early stages of the infection.

DR GILBERT S. LEVY (MEMPHIS, TENN.)—I was particularly interested in the geographic distribution of the cases inasmuch as our cases represented the majority of the cases in the outbreak of two years ago in Tennessee. It so happens that we are geographically situated as to get many cases from Mississippi and Arkansas.

The mortality during that outbreak was 45 and a fraction per cent. Strangely enough, this was the first time in sixteen years we had a severe outbreak.

Another phenomenon was the fact that the majority of cases in 1916 came from a certain part of Arkansas, in fact, the district surrounding the St. Francis River has a small community called the Panto, and in that same district a hundred cases occurred in 1916, and most of them were treated in Memphis.

In the beginning of this outbreak in 1930 and 1931, the same thing happened again, and even now we are still receiving cases. This year we have had three cases from that same neighborhood. It seems they will never be free from the carrier situation in that locality. So far as we have been able to discover, there has been no effort made to study the district and the situation.

We had a mortality rate of 23 per cent, which was in striking contrast with Indianapolis with more than 64 per cent. The mortality among the negroes was 13 per cent higher than among the whites. This is easily understood when it is known that the negroes are forced to live in small homes, sometimes four or five sleeping in the same bed. These cases were thoroughly investigated by the health department.

One other interesting fact was that we had eleven families with from two to four cases. The total number of cases for that year was approximately 300.

Dr Bell quoted from Dr Lewis, who made the findings, and you note he said there were three cases of sudden blindness. These three went blind overnight. He made a very thorough study of these cases. He thought there might be a reason for one of them, but he still does not know about the other two.

DR ROBERT H. McBRIDE (SIOUX CITY, IOWA)—I wonder if the percentage of meningitis in young infants is not greater than we have thought, and the death rate also greater?

I believe a very large number of infants under six months of age, said to die of diarrhea, die of unrecognized meningitis.

I had the opportunity during the past winter of seeing a child who became ill

about three o'clock in the afternoon with malaise, headache and temperature. At six o'clock he was very ill. About eight o'clock the first petechia appeared on the skin. At this time his lumbar puncture showed twenty-four cells and no organisms. A blood culture was taken. He was given intravenous treatment. The following morning he had about 12,000 cells in the spinal fluid and the blood culture was found to be positive. He was treated in the ordinary manner. He developed blindness in one eye but never became sufficiently ill to lose consciousness or become delirious. The disease ran a mild course, but he did lose the sight of one eye completely.

I feel that they get the ophthalmia about the same time they get the petechiae on the skin and that it is a hemorrhage in the eye, and that the organisms are carried directly there.

There is a great deal of ear trouble. Many times the child becomes completely and permanently deaf. It is interesting to know why it is such a selective thing and why a child becomes permanently and completely deaf.

DR. GEORGE J. MYERS (CHICAGO).—The thing that surprises me in the few cases we have had in the Children's Hospital is the comparative mildness of the disease in the early stages. It seems to me it is quite apt to fool the attending physician. I have wondered if many such cases are not missed. We have had in our wards children who presented only a slight stiffness of the neck and a mild stuporosity. We do not get to follow these cases because as soon as we find a meningococcus infection, we send the patients to the municipal contagious hospital.

DR. STANLEY GIFFEN (TOLEDO, OHIO).—I think it is very difficult to know in the case of a young child or baby who is vomiting but has no other symptoms whether to send him to the hospital for a spinal puncture.

I had a case this winter, a three-month-old baby, who was vomiting. When I saw the child, he had no fever but was vomiting and had an acetone breath. I thought at the time it was nothing but a case of starvation acidosis etc. I treated the child accordingly and was much chagrined several days later to hear that the baby was still vomiting. I made a spinal puncture and found meningococci present. We treated it but the baby died. At autopsy we found the ventricles contained thick creamy pus.

I wonder whether or not we should puncture all vomiting babies.

DR. THOMAS J. MARSHALL (PAIDICHA, KY).—About two years ago we had an epidemic of meningitis affecting adults also. I think the first case was a boy visiting from Detroit. This occurred in December and we continued to have meningitis along until early in the spring. We noticed when the weather was damp there would be two or three more cases of meningitis, and when it was dry there would be no new cases. I wonder if weather conditions do have anything to do with it.

DR. BELL.—There does not seem to be any proved connection between weather conditions and morbidity.

DR. TOOMEY.—I would like to refer to meningococcus staining. This organism is gram negative. In the last ten years or so a modification of the Gram stain by decolorizing with acid alcohol or acetone has been widely used. We have used this method and have finally discarded it as impractical. In a case of meningitis or suspected meningitis where the fluid is to be stained in that fashion a control is absolutely necessary to test the efficiency of the decolorization. It is better to adhere to the old fashioned Gram method of decolorizing by alcohol.

I would like to ask Dr. Bell whether from his reading of the literature he can give us some information about the toxins now being described as associated with this infection.

DR BELL.—It has been inferred that many patients die of meningitis though diagnosed as having a different disease. I think this undoubtedly occurs. If one is not expecting it, a case may be missed especially since many other conditions have meningeal symptoms, such as ilocolitis or some entity from which the child becomes very ill and comatose. I have no doubt but that there are cases of meningitis classified otherwise on the death certificate.

It has been brought out in other places, especially since the World War, that there is a high negro mortality. This susceptibility of the negro race will have to be admitted in our textbooks.

In mild cases of nasopharyngitis, it may be possible that the etiologic factor may be the meningococcus.

I am not sure that it is possible to have only a septicemia without meningitis.

If, during an epidemic of cerebrospinal meningitis, cases make us suspicious, and if we have many cases of vomiting in infants with fever, recourse should be had to a spinal puncture. It is only by being alert that we may be able to detect these conditions early enough for proper treatment to be instituted.

I am sorry I cannot elaborate on the toxins associated with this infection.

Dr Shaw spoke of the invasion of other organisms as possibly being due to degeneration of the vascular system, I think that would be a probable and likely explanation.

Remarks on the efficacy of therapeutic serums were then made by Dr E B Shaw.

The Treatment of Meningococcus Infection

Edward B Shaw, M.D., San Francisco, Calif

In a discussion of the treatment of meningococcus infection we must confine ourselves largely to specific therapy inasmuch as other methods of treatment have been attended with little success. The mortality of untreated meningitis is high, and such methods as spinal drainage, spinal lavage, and the intraspinal application of various antiseptics have improved the end results but little. This paper has been designed to present the essentials of the subject to initiate round table discussions, omitting much controversial matter. Much of it is opinion advanced in the belief that it is correct but with the expectation that it may provoke sound disagreement.

The use of antimeningococcus serum was introduced during the early years of this century almost simultaneously by Jochman and by Flexner. Since this time attention has been directed to improvements in the methods of serum production and the manner of its application. One gains the impression that the serum first employed exhibited strikingly specific properties but as commercial production was undertaken during an interepidemic period therapeutic properties seem to have waned and were found sadly wanting during the extensive war time epidemics. Reinvestigation of methods of production at this time resulted in improved specificity and therapeutic effectiveness. The period after the war has perhaps witnessed another wane in serum effectiveness, and good observers are now to be found who completely distrust its value.

Methods of Preparation.—In the production of the first serum a few clinical strains were used. The observation that there were many divergent strains led to the inclusion of more and more strains in the suspension used for immunization, until finally this procedure became almost insuperably cumbersome. It was found by Netter, Dopter, Gordon, and others that meningococci could be classified in a manner resembling pneumococci classification, into two, three, or more groups. This naturally led to the attempt to select, for the treatment of each case, a monovalent specific serum. Practically, however, this was found to be difficult because it was

found to be better to treat immediately with polyvalent serum rather than to delay for the period necessary for classification.

The method at present regarded as acceptable consists of the immunization of horses with a suspension containing representatives of each of the three recognized groups. Such a serum when carefully prepared is usually specifically effective against clinical strain. A potent serum is stated to contain bacteriostatin, agglutinin, precipitin and bacteriotropin and to possess antitoxic and antixotoxigenic properties difficult to evaluate. The potency of serum is usually judged by its agglutination titer against type strains but admittedly this falls far short of predicting precisely clinical effectiveness. A satisfactory agglutination titer indicates simply that the necessary strains have been included in the antigen and that an immune response has been provoked. Actual therapeutic properties depend on other factors which may or may not parallel the agglutinin. The agglutination response may not be significant either in the antigenic activity of the meningococcus suspension or the therapeutic effectiveness of the serum produced. Zlotnikovsky has been able to produce meningitis in rabbits by the intrathecal injection of freshly isolated strains of meningococci and was unable to do so with laboratory strains. In the infected animals therapeutic effectiveness was demonstrable with serum prepared against freshly isolated strain. The use of those prepared by immunization against laboratory strains was ineffective.

There are many studies which suggest that it is desirable that serum possess antitoxic power; even the earliest attempts at the immunization of horses included the injection of an antitoxin along with the bacterial suspension. Certain clinical observations suggest the possible rôle of toxins in the pathogenesis of the disease. Recently tests which may be of value have been designed to determine the antitoxic activity of serum.

The final word has not yet been spoken upon the production and standardization of serum. At present this procedure is incapable of any such routinization as applies to the production of diphtheria antitoxin. Best results are secured when all procedures are constantly subjected to searching study of an investigative nature and when laboratory results are carefully checked with the clinical response.

Selection of Serum.—There is no means of selecting in advance the best serum for use in a given case. All serums are designed to be effective against any strain and since treatment should usually be started on the basis of information which is largely clinical and not bacteriologic, any available one may be chosen at first. It is commonly thought to be desirable finally to select from the products at hand the serum most specific against the offending strain. This can be done at present in only two ways:

1. A growth of the organism is secured as quickly as possible from the blood, spinal fluid or nasopharynx of the patient, a bacterial suspension prepared, and an agglutination reaction carried out with several serums. The serum which produces agglutination in the highest dilution frequently will be most active therapeutically. It must be remembered however that good results will be secured often with a serum of poor titer and it has been observed sometimes that one of high titer will be less effective than another giving a poor agglutination response.

Mention should be made of the fact that recently isolated strains often agglutinate poorly. We recently selected a number of strains in which various serums produced agglutination in only the lower dilutions when freshly isolated. None of these agglutinated in dilutions of over 1 to 40 and one could not be agglutinated in dilutions of more than 1 to 20, even by a very powerful type-specific serum. After these strains had been grown for several generations on laboratory media, they agglutinated with several standard serums in dilutions of from a 1 to 400 to a 1 to 4000 only one remained inagglutinable above 1 to 400.

The evidence supplied by this test is only roughly suggestive and must not be followed blindly. Various preparations of the same manufacturer are not necessarily identical. It seems pertinent to suggest that study should be directed to the end that all serums be applicable to every case rather than that methods be developed for selecting the best serum for each individual one.

2 The clinical response in each case should, of course, be carefully watched, and, if the response to treatment is unsatisfactory, another serum may be chosen for continuance. This procedure is especially applicable to epidemics in which the same strain may be encountered throughout and in which one serum may be selected on the basis of the results in several cases.

In the individual case it is difficult in the first few days to evaluate the response to treatment. Serum produces an increase in spinal fluid cell counts, patients varying considerably in their response to this nonspecific irritating effect of serum which is altogether independent of the attendant disease. Despite subsequent recovery of the patient, organisms may be more numerous in several succeeding fluids than in the first one examined. There is, of course, no harm in changing to another serum which should at least be equally effective if one feels that the clinical response is unsatisfactory.

Method of Administration—The plan of treatment in cerebrospinal fever must be designed with respect to the nature of the pathogenesis. The initial focus of upper respiratory infection is almost inevitably overlooked. The stage of dissemination, which follows frequently, gives a clinically recognizable picture, consisting of marked sepsis without obvious source, usually with high fever and prostration together with a rash of hemorrhagic character, which, if present, is almost pathognomonic. This is succeeded by various gradations of sepsis combined with meningitis which culminate in localization in the meninges with, in general, the spontaneous regression of the sepsis.

Cases of meningococcus sepsis, in order to be treated to forestall meningitis, must be treated on the basis of clinical signs. If these signs are not recognizable, the disease usually progresses to meningitis before it is diagnosed. All too frequently, however, meningeal localization occurs during a delay for exact bacteriologic diagnosis in the face of clinically positive symptoms.

Treatment in cases of manifest sepsis consists of the intravenous administration of serum in a dosage based roughly on 100 cc for an adult. Children who withstand the disease poorly and the serum well should receive a dose somewhat larger than one proportional to age and weight. Small infants may be given from 10 to 15 cc or more. Unless the urgency of treatment is great, precautions against serum hypersensitiveness should be employed. These consist of a careful history for general or specific protein hypersensitiveness and the performance of an intracutaneous or ophthalmic test with diluted serum. It is sometimes worth while to attempt to "desensitize" the patient before intravenous injection. In many non-sensitive cases it is at least worth while to precede intravenous injection by an intramuscular initial dose of $\frac{1}{4}$ to $\frac{1}{2}$ cc, given in an extremity in such a location that, if immediate reaction occurs, a tourniquet may be placed proximal to the injection, absorption impeded, and epinephrine administered to combat the reaction. In many cases the emergency of the disease justifies intravenous therapy without any preliminary precautions. In all cases the first few centimeters injected intravenously should be given very slowly and the entire amount given as slowly as possible. It helps to reduce nonspecific, and perhaps specific, reactions if glucose solution is either mixed with the solution or given coincidentally. Epinephrine solution must always be at hand, in a loaded syringe, when any serum is given.

We have found it advantageous in giving intravenous injections of any serum to begin by injecting, by means of a gravity apparatus, a quantity of glucose, 10

per cent, in normal salt solution. As this solution is permitted to run slowly into the vein, the serum is slowly injected into the stream of glucose solution by means of a hypodermic syringe, the needle being introduced through the wall of the rubber tubing of the gravity apparatus. By this method the rate of flow of the serum is always under careful control and the admixture of glucose solution is very effective in the prevention of reaction.

The response of septic cases to intravenous treatment is much more strikingly specific than in cases of meningitis. All symptoms may regress in a few hours. This result would seem not to depend so much upon lysis and destruction of the circulating organisms as upon the neutralization of bacterial toxins which produce vascular damage and are responsible for the progress of the disease.

The repetition and frequency of dosage is not a matter of rule. A single intravenous dose is probably adequate but it is usually repeated once or twice

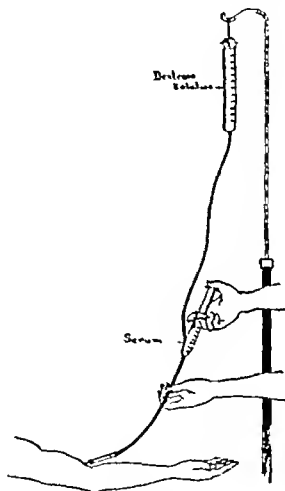


Fig. 1

thereafter. It is not only unnecessary but probably actually harmful, to inject serum into the spine unless there is demonstrable evidence of infection of the meninges.

Treatment of Meningitis.—If there is early involvement of the meninges, there is because of the very nature of its pathogenesis coincident sepsis. Many observers feel that such cases merit intravenous treatment although others, feeling that intravenous treatment in this stage is not particularly helpful and is an added risk to the patient, assert that treatment should be entirely intraspinal. In these cases of commingled sepsis and meningitis intravenous treatment is useful if the sepsis is marked and the meningitis somewhat less so. In some of them the spinal fluid may show only a few cells and few or no organisms, and meningeal signs may be produced by vascular changes in the pia arachnoid, which initiate the meningitis. In these very early cases all of the areas of infection may be accessible by way

of the blood stream, and serum should be given intravenously at the onset. In slightly later cases, despite the presence of an outspoken meningitis, the intensity of the disease picture may depend more on the sepsis, and intravenous treatment seems to improve the general picture greatly.

As the disease progresses, the sepsis tends to be spontaneously eradicated and the rational of intravenous treatment diminishes. However, as long as there is demonstrable evidence of persistent sepsis, it seems logical to give a single intravenous dose at the onset of treatment, but its repetition is unnecessary, particularly since intraspinal serum serves to maintain blood stream saturation.

Intraspinal treatment depends, perhaps, on different principles of serum activity than when serum is given into the blood stream. In the meninges, serum probably attacks the organisms directly rather than serving to neutralize bacterial toxins. One should endeavor to maintain intensive saturation of the subarachnoid space over a period of several days. Numerous practical points are important.

Diagnostic lumbar punctures should not be performed in a suspected case except under conditions which permit immediate administration of serum and adequate study of the fluid. If the clinical picture is sufficiently suggestive to indicate lumbar puncture and if a cloudy spinal fluid is obtained, serum should be given without delay for bacteriologic diagnosis. Proper restraint of the child in the supine position requires more skill than the puncture. A general anesthetic is seldom necessary. The use of a local anesthetic, infiltration with a 1 or 2 per cent procaine, is sometimes desirable but is usually unnecessary at subsequent treatments as it produces edema and an increased tendency to skin infection, which is undesirable. Careful antisepsis of the skin area and a strict aseptic technic are essential. The use of a miniature laparotomy sheet to drape the area is convenient. A large needle, to permit ready withdrawal of a large amount of fluid, is introduced with care to avoid drawing blood. The first few centimeters of fluid are slowly withdrawn, and as pressure falls, the fluid, if cloudy, is permitted finally to flow unimpeded. It is desirable to withdraw as much of the infected fluid as the general condition of the patient will permit, his color, pulse, and respiration being carefully watched. Usually from 30 to 40 c.c. can be secured from young infants and as much as from 50 to 80 c.c. from adults. This first treatment is the most favorable moment for the withdrawal of a large amount of fluid, which is seldom heavily purulent, and the blockage of flow, which results from the progress of the disease and from the effects of treatment, is seldom encountered.

A few drops of the fluid are allowed to flow directly from the needle into a previously warmed tube of Loeffler media (ordinary throat culture tube) and the remainder of the fluid is sent warm to the laboratory for examination and culture.

At the end of withdrawal, an amount of serum slightly (from 5 to 10 c.c.) less than the amount of fluid withdrawn, which has been previously warmed to about body temperature, is slowly introduced without delay by means of a gravity outfit. For the same reasons which facilitate fluid withdrawal, this is the best moment for the introduction of a large amount of serum. At later treatments there has been dissemination of infection, and there is more tendency for the fluid to become more purulent and for the infection to become locally walled off. The needle should finally be quickly withdrawn and pressure applied to prevent leakage of serum into the lumbar subcutaneous tissue.

As quickly as possible, the diagnosis should be confirmed by the laboratory and a growth of the organisms secured, against which the agglutination response of various serums may be tested.

Immediate serum reactions less commonly follow intraspinal than intravenous treatment, and the seriousness of meningitis commonly justifies dispensing with elaborate precautions against them. If the history suggests sensitivity particularly,

the precautions previously referred to may be employed. Sudden shock sometimes follows treatment, resulting less from specific serum effects or from the sudden release of pressure than from increased pressure due to brain edema with consequent pressure on the medulla and interference with respiration. This is sometimes immediately fatal and is difficult to control. If it occurs, pressure should be relieved by prompt withdrawal of fluid and the patient placed head down. The administration of 5 per cent CO_2 and 30 per cent oxygen is sometimes of value in combating milder degrees of respiratory embarrassment.

Following the first treatment the fluid usually becomes increasingly turbid due to the irritating effects of serum and perhaps, to the stirring up of infection. Organisms are curiously, often more numerous in fluid withdrawn at the second puncture.

We prefer to give a second treatment in twelve hours. Other observers with more experience believe a twenty-four hour interval is more desirable. Whatever exact plan of treatment is adopted it should be the reverse of the common practice of treating cautiously at first and heroically later. It is much better to treat most energetically at the very onset. Our plan of treatment consists of the introduction of large amounts of serum every twelve hours for from four to six doses, then at twenty-four hour intervals for several days. The twenty-four hour interval may be preferable throughout. Treatment should rarely consume more than one week. For a time the patient may show signs of meningeal irritation due to serum which may completely obscure evidences of improvement. Meanwhile serum for the continuation of treatment should be selected. The use of concentrated serum, containing more specific antibodies per unit of volume may be desired when it is possible to introduce only a small amount each time. It seems advantageous, however to withdraw as much of the infected fluid each time as is possible and to introduce a volume of serum only slightly less.

Lyon has proposed a method of experiment use in infants of introducing coincidentally ventricular and spinal needles, admitting serum from one as fluid is withdrawn from the other and permitting the introduction of very large amounts of serum.

As treatment progresses it is important that in addition to careful observation of the patient's condition the fluid be examined for evidences of improvement. The tendency is toward undue prolongation of treatment. Not infrequently the patient shows more evidence of meningeal irritation when treatment is stopped than he presented at its initiation. Cell counts usually rise after the first treatment, in response to successful therapy they slowly fall but after one week, because of sensitization of local tissues to serum each treatment may cause a rise in cell count, increased meningeal irritative signs, and even rise in temperature. Definite evidence of improvement is seen in

- 1 Diminution and disappearance of organisms from cultures and, especially, from smears.

- 2 An increase in spinal fluid reducing substance.

Examination of spinal fluid for both these factors should be carefully employed daily and serum may be cautiously withheld after a period of intensive therapy with the disappearance of organisms and the rise of spinal fluid glucose. We have occasionally ceased treatment for a time when a few scattered organisms were still present and when glucose was low after a satisfactory serum had been intensively employed over a period of from five to seven days, thereafter a rapidly favorable termination was seen.

When it is felt that serum may safely be withheld, the patient is thereafter watched very carefully and daily examinations of the fluid are made for cells, organisms, and the amount of reducing substances. When a good therapeutic

effect has been secured, there may ensue, following cessation of treatment, rapid improvement in the patient's condition, a rapid decrease in spinal fluid cell count, the consistent absence of organisms, and the presence of a normal amount of reducing substance

Relapses seldom occur if this plan of early intensive therapy is employed. If they are encountered, as evidenced by increased symptoms, increased cell counts, a fall of spinal fluid reducing substance, and the reappearance of organisms, recourse must be had to a resumption of intensive treatment

Alternative Methods of Treatment—Some observers prefer to administer serum by way of the cistern. This is technically easier than lumbar puncture and permits the advantageous use of large amounts of serum. If there is much intracranial pressure, however, the cistern may be nearly obliterated and cisternal puncture becomes highly dangerous. It is difficult to see any advantage in the withdrawal of large amounts of fluid by this method over the withdrawal of similarly large amounts by lumbar puncture. This method is justifiable only when it is impossible to obtain large amounts of fluid by lumbar or ventricular punctures because of local block or to the thick character of the fluid. Its necessity is obviated particularly by early and intensive therapy

Intraventricular treatment is also sometimes a matter of necessity when block occurs, especially blocks at the external foramina such as are frequently encountered in infants in whom the disease may be very advanced before its recognition and in whom the exudate may become thick and fibrinous quickly. This method permits the use of large amounts of serum, is easy in infants with open fontanelles, and is more difficult when a burr opening must be made. It is also usually obviated by intensive early treatment, the withdrawal of large amounts of fluid by the spinal route which nearly drains the ventricle, and by the introduction of large amounts of serum

CONCLUSIONS

The treatment of meningococcus infections is a matter governed largely by clinical considerations. Treatment should usually be instituted on the basis of evidence which is entirely clinical, and during its continuance, laboratory procedures are a subsidiary, but none the less essential detail. It is particularly desirable that treatment be energetically applied from the outset and not at first timidly applied in a manner which permits the disease to progress to an extent which makes manifest the necessity for more intensive therapy at a later stage

It seems logical that the study of serum therapy should be directed to the end that each serum be specifically effective in every case. No procedure will precisely determine the best serum for the treatment of the individual case

DR TOOMEY—Dr Shaw's remarks are now open for discussion

DR LEVY—I am very much opposed to lumbar puncture in infants, children, or adults without an anesthetic. I have never been able to convince myself that an individual suffering from acute meningeal disease does not suffer pain, irrespective of the type of anesthetic used. Particularly in infants, I favor the use of 1 per cent novocaine. In older children and adults, particularly when pressed for time, the use of ethelvn gas and oxygen has been found very favorable in our hands. We have used it about two thousand times without any serious results. When there is plenty of time, I favor the use of novocaine

With reference to the use of therapeutic serum in a rather large series of over five hundred cases, our conclusion until just recently was that no particular type of serum afforded any spectacular results. At the present time we are using an antitoxin which is made after the method of Dr Ferry. It is too early to say so very much about it, as we have had only eleven cases since the first of the year

I understand from Dr. Lawson they are using the same therapeutic serum here in Chicago. Eleven cases is too small a series to mention perhaps. I have seen years when we have had a mortality rate of 80 or 85 per cent and at no time has the rate been less than in the outbreak of 1910. With this new antitoxin, our mortality rate was 40 per cent. We have had only one death out of eleven patients thus treated. This one patient, an eight-year-old negro child, was in the hospital for just six hours.

The other patients ranged in age from eleven months to forty years. There were nine white and two negro patients.

One of the patients had chronic meningitis having been ill for five weeks. When the child left the hospital there was some evidence of hydrocephallitis. The child was able to sit up in its mother's lap a week later.

Six of these patients developed serum sickness. The serum has been used intravenously and intraspinally. The adult dose was from 75 to 100 c.c., and the dose for children from 25 to 40 c.c. in saline or glucose.

We have paid very little attention to desensitization of the cases of meningitis. I always feel if there is a history suggestive of sensitization, we can incorporate a minimum of chloride in the intravenous medication.

Perhaps a report like this should not be mentioned but I think it might be well to exchange our findings and results.

DR. McBRIDE.—In a case where there are skin symptoms and other symptoms of meningitis and you feel pretty certain of a diagnosis, but the cell count is relatively normal, what is your procedure? Do you treat them intraspinally or intravenously and await the other treatment?

There is another thing I would take exception to—that is the size of the needle. I do not believe it is necessary to anesthetize the small child under three or four if you use a Luer needle with a short bevel and a small bore. It seems to me one gets very good results with it. If the injection is intraspinally there is very much less bleeding later. Considerable hemorrhaging due to the trauma of the needle occurs during the later part of the treatment and there is loss of hemorrhage with a small needle.

In regard to stopping the flow of the spinal fluid after having concluded the treatment and withdrawn the fluid when the puncture is done the child is flexed and the vertebrae are spread apart posteriorly. Following the puncture, the child should be allowed to hyperextend the back, which he does spontaneously to close this opening between the vertebrae.

It has been my experience that the second and third punctures show more organisms and usually more cells.

DR. TOOMEY.—I quite agree with Dr. Shaw that a local anesthetic is not necessary for most cases.

I think he made a very good point when he called attention to the fact that in private practice one can forget all about bacteriologic cultures and agglutinations and determine the choice of antitoxin and the further course as far as the patient's treatment is concerned, by the clinical benefits received.

I think we should be careful about treating patients for relapsing meningitis when they start to get serum sickness symptoms seven or eight days later, arthritis, hives, etc. We have seen patients that probably never would have recovered if the serum had not been stopped. I agree with the use of mass doses at first, later tapering off. Give large doses the first two days and then give a small amount of serum intramuscularly every other day for five or six doses. Then if there is a relapse, more serum should be given without fear of sensitivity reactions.

There is one point about which I disagree and that is desensitization. I have never seen any benefits from desensitization in any form. Some desensitization

of the individual who shows a definite type of reaction or positive history may have to be done in order to keep away from legal complications or possible suits.

As a matter of fact, in the last ten years we have finished an analysis of cases and divided them into a group that was sensitive to diphtheria antitoxin and a group that was not. We have injected both of these groups with diphtheria antitoxin and have found that more individuals who were desensitized had reactions as compared with those who were not desensitized.

DR McBRIDE—Do you feel that by giving a very great amount of fluid either intravenously or by mouth that the toxin in the blood stream or in the cerebrospinal fluid is diluted enough so that you will relieve the serious symptoms, such as permanent deafness? For instance, if you have a very sick child and fluids are forced very extensively, do you feel that there will be an effect upon the nerve deafness?

DR SHAW—No

DR TOOMEY—I forgot to mention a very curious experience about this deafness. For ten years we did not have one case, and then in August, 1931, we had six cases in one month. Four of these were permanent, and two recovered in six months.

DR McBRIDE—I had three cases in the past winter, and I had only three previously. I would like to get some idea as to why these patients become deaf and if there is some possibility of preventing it.

DR SHAW—I think the reason for the deafness, and I would be interested in hearing other opinions, is not due so much to the involvement of the nerves as probable involvement of the inner ear.

DR McBRIDE—I had one patient who left the hospital in fairly good condition after ten days, three weeks after she was entirely convalescent, she developed complete deafness and is still completely deaf. I have never had one whose hearing made any improvement after becoming deaf.

I have been unable to contact any one giving a suggestion as to what may be done previous to the deafness to avoid it. The only thing I have tried to do is to increase the amount of fluid, hoping if that was toxic to dilute it as much as possible.

DR SHAW—It seems to occur in patients who seem to be progressing satisfactorily when the deafness is noticed.

I wanted to ask before closing if there wasn't any disagreement on the cisternal puncture. I do not like it.

DR McBRIDE—It is a very useful method in case you cannot puncture the spine, or in case you cannot get enough fluid out or enough serum in. It is somewhat dangerous.

Some one should mention the lack of symptoms in the child with open fontanels. Most of them do not have a single sign of meningitis. They will not have increased reflexes and they may not have a bulging fontanel. I feel this may be the reason we lose some cases. It does not hurt a baby to make a puncture, and we lose them because they are not diagnosed.

DR SHAW—I do not mean to state that I never use local anesthesia. It is sometimes wise to use a local anesthetic for the first puncture, but at succeeding ones the child's mental state usually makes it unnecessary. Repeated skin infiltration causes undesirable edema of the lumbar region and encourages skin infection. The patient who struggles violently against treatment may be given nitrous oxide and oxygen, or ether, though this is seldom necessary.

I am glad to hear of Dr. Levy's experience with this newer strongly antitoxic serum. It has been difficult experimentally to prove the existence and nature of these toxins, as a perusal of Gordon's work will show. Numerous experimental observations, however, strongly suggest the existence of exotoxin and endotoxins which are of importance in the pathogenesis and indicate the necessity for an antitoxic component of the serum but clinical observations must supplement laboratory data in this matter. It seems that proper appreciation of the intoxication and the use of strongly antitoxic serum may be of great importance in future therapy.

In my manuscript I had "desensitization" in quotation marks and I tried to put the quotation marks into the reading. I do not know if we can truly desensitize, but there is no doubt that sensitization occurs. There is some comfort in being forewarned of the presence of serum hypersensitiveness by a cutaneous or ophthalmic test. Nonspecific methods of combating reactions are of value whether or not specific desensitization is effective.

Extremely sensitive cases are a difficult problem. We have one patient so sensitive to horse emanations that the application of manure to the yard caused him to have a severe asthmatic attack. Could such a patient by any method of desensitization be safely treated with serum intravenously? It would at least be a hazardous undertaking.

The method Duke introduced for pollen injections is valuable. All subcutaneous or intramuscular serum, particularly initial doses, should be given into an extremity in such a location that if a reaction begins a tourniquet may be placed proximally so that absorption may be impeded. Only in emergency should serum be given intravenously without any kind of precautionary preliminary injections.

I have sometimes questioned if we do not increase the severity of late serum disease by a number of repeated small injections. It has been my observation that the urticaria, joint and gland swellings, etc., of late serum disease seem to be more troublesome in clinics in which serum is given with elaborate precautions than where serum is given with no precautions at all. Precautions are of course not directed toward late serum disease but are directed against immediate reactions where a fatal outcome is to be feared.

There is no doubt that an occasional patient may be rendered serum hypersensitive by continued injections of serum, although this is not invariably the case. I am reliably informed of a patient, whom I did not observe. Following prolonged treatment for meningitis consisting of intravenous and intraspinal serum, the patient was discharged as recovered. After several weeks symptoms recurred and he was found to have a positive blood culture. Serum was again promptly given intravenously, and after the first few minims had been injected, the patient died.

There is no doubt that many cases are overtreated. A neurosurgeon said the meningitis patients he sees seem to recover promptly when he has serum stopped. The fairly obvious answer is that neurosurgical consultants are called when cases are prolonged and doing badly and when adequate serum treatment has already been given.

As to the size of the needle I prefer a large needle so that a large amount of fluid can be promptly drawn. The fluid is sometimes thick and full of fibrin flakes. A large needle obviates blocking and accelerates the procedure.

DR. McBRIDE.—What size?

DR. SHAW.—Much bigger than an intramuscular needle. I use one of the larger ones which accompany the usual outfit (from about size 16 to 18).

With regard to the patients with low cell counts, and the question of whether purulent fluid may be at a higher level which only appears in the lumbar spinal fluid later, we have had a number of early cases in which the cell counts have been so low that we have wondered if there was more extensive infection over the base

or in the ventricles. This question was answered in one such patient, who had been sick only a few hours and who showed slight neck stiffness and a few petechiae. Lumbar puncture showed a slightly turbid fluid containing many fibrin flakes but less than 200 cells per c.mm. She was treated intraspinally and died without warning about four hours later, apparently from pressure associated with brain edema. Autopsy showed no collections of pus anywhere but a diffuse and fairly uniform glazing of the pia arachnoid. Organisms were first demonstrated in postmortem smears and cultures.

The frequency of treatment is a matter of disagreement. Many well qualified observers hold that daily treatments are sufficient. Serum is absorbed in about eight hours so that it seems logical to treat at shorter intervals, especially during earlier and more florid stages of the disease.

We force fluids in most febrile illnesses, and to do so seems reasonable in this one. It is a question if the additional fluids cause increased flow of spinal fluid as much as do repeated or continuous drainage. Certainly after fluid has been withdrawn frequently for several days there seems to be a definite increase in secretory rate so that sometimes punctures are necessary for the relief of pressure.

Glucose is a valuable agent used intravenously in these cases. In addition to its nutritive and detoxifying virtues, it seems materially to help in the prevention of serum reactions.

Diagnosis and treatment are both difficult in infants. Sometimes the performance of a lumbar puncture will be suggested by the barest hint. It is essential that lumbar punctures be performed on suspicion and that treatment should be most intensive from the start. It is especially in this age group that the most insuperable complications occur.

DR McBRIDE—I had a similar experience in the spring. I watched the child twenty-four hours and failed to find any explanation for the illness. Routinely I made a lumbar puncture and found meningococci. I gave the intraventricular treatment, and the child recovered. I think we miss many cases in small children.

Dr Toomey then introduced the next subject for discussion, namely, "Differential Diagnosis."

DR SHAW—I would like to ask a little more about meningomyelitis as you encounter it. How many cases have you seen and what relation have those cases to poliomyelitis? I would like to hear a little more about these cases.

DR TOOMEY—The sugar content of the spinal fluid is decreased in tuberculosis also, but you have a different clinical picture.

In answer to Dr Shaw, we are vitally interested in infantile paralysis and have encountered this syndrome of dissociated meningoencephalitis in our studies of winter cases of poliomyelitis. We analyzed all these cases of poliomyelitis occurring between January and June. In looking over the histories of these cases, we convinced ourselves that approximately twenty-six of some thirty-odd cases might have been some form of encephalitis but not poliomyelitis.

The Board of Health statistics reported quite a few cases of poliomyelitis in the winter months. Most of these cases probably were epidemic encephalomyelitis. This year we have eight.

In a recent article in the *Journal of the American Medical Association*, McIntyre describes twenty cases of a new encephalopathy. I quite agree with him that there are a number of cases which might be characterized as acute myeloencephalitis, but I do not agree that all of the cases he describes could be so included under the new term. In this new syndrome, paralysis coming on without much warning is noted. This occurs most commonly in the early morning. The patient will have little or no disturbance of deep sensation. He will point to his

toes all right he will locate his nose perfectly well. He will not be stuporous. He cannot distinguish the difference between hot and cold. Lumbar puncture may show no cellular increase. The fluid may be clear but one striking thing is that even though clear it will have a 4+ globulin. Often there is a slight cellular increase but it is very slight and usually of a lymphocytic character.

A striking thing about these individuals is a bladder paralysis at the onset and a paralysis of the lower rectum. Another striking thing is the clinical sequence. Nearly all recover and very rapidly. Their bladder functions will return in about seven days at the most. Their bowel function may recover quicker. An individual often recovers from the paralysis in twenty-four hours.

I do not see how one is justified in making a definite new entity of this condition. Haxsin has made important contributions to the literature on the effects of toxins in the nervous tissue. As I remember his article, it appears to me that the pathologic results of all these toxins as Dr Shaw intimated, must be related and that one clinical syndrome has a little more or less severe degree of vascular reaction than another.

Haxsin has indicated that it is absolutely impossible to differentiate encephalitic types of reaction that occur in nervous tissue.

I feel that McIntire has seen cases who were poisoned with a more virulent toxin.

DR. GIFFEN—In diagnosing tuberculous meningitis do you often find the tubercle bacilli?

DR. TOOMEY—Perhaps we have been fortunate for we have been able to find the bacillus in the spinal fluid in the majority of our cases after a painstaking search.

The meeting was adjourned at 5:30 P.M.

REPORT OF THE COMMITTEE ON HOSPITALS AND DISPENSARIES

(CONTINUED)

The general data concerning children's hospitals in the United States and Canada were obtained from the same questionnaires and therefore under the same conditions as the data regarding the staffs.

As many answers to this section of the questionnaire are incomplete or indefinite or omitted altogether an accurate summary is hardly possible. However the following general picture is presented.

Thirty-two of the group of thirty-five hospitals are in the United States and three in Canada. Those in the United States are located in seventeen states: California, Colorado, Illinois, Indiana, Maine, Maryland, Massachusetts, Mississippi, Michigan, Missouri, New York, Ohio, Pennsylvania, Washington, Wisconsin, and Iowa. These hospitals are in our largest cities:

1 Los Angeles	1 Akron	1 Detroit
1 San Francisco	1 Cincinnati	1 Ann Arbor
1 Denver	1 Cleveland	1 Kansas City
1 Seattle	1 Indianapolis	1 Saint Louis
1 Washington D. C.	1 Iowa City	1 Staten Island
4 Chicago	1 Portland Maine	1 Columbus
1 Baltimore	2 Boston	1 Pittsburgh
4 New York City	1 Philadelphia	1 Milwaukee
		1 Buffalo
Canada		
1 Winnipeg	1 Toronto	1 Montreal

Twenty seven of these institutions are located east of the Mississippi River and only five west of the Mississippi.

It is interesting to note at this point that, while there are only thirty two children's hospitals, there are 6,667 registered hospitals in the United States and of these 4,021 are properly designated general hospitals. Children's hospitals are, therefore, less than 0.5 per cent of the total. The natural inference is that the general or other hospitals throughout the United States have departments for children and must take care of a large percentage of the children entering hospitals. This is correct, for the hospitals and dispensaries report of the White House Conference on Child Health and Protection shows a total of 81,055 beds available for children and about 47,939 bassinets, a combined total of 13 per cent of all hospital beds.

In four children's hospitals west of the Mississippi, there are 721 beds, a relatively small number in comparison to the population of that area. The fifth hospital failed to answer that section of the questionnaire.

The cost of buildings, without land values, of twenty five institutions reporting, amounts to \$23,779,037, an average of \$951,180 per institution. Taken as a whole, the buildings are moderately new and seem to be fairly well located as to their general surroundings (such as sunlight and lack of noise) considering that these hospitals are in large cities, consequently in or near congested areas. Only five are in better class residence districts.

With the exception of three, the group represents private enterprise, one being under county control and two under municipal control.

Superintendents in charge are classified as follows:

10 male physicians	17 female registered nurses
5 male lay persons	1 female lay person

It is seen that registered nurses predominate in number.

As far as can be determined, the work done by these institutions is nearly all charity, the income from patients being negligible. Three quarters of the general hospitals also accept children as free patients. For their maintenance, the children's hospitals derive their income from the following sources:

a. City, county, or state	(21)
b. Endowment fund	(30)
c. Private contributions	(35)
d. Community chest	(?)
e. Income from patients	(?)

Figures are not in form to show with any accuracy the amounts the group as a whole derives from each of the above sources. However, income from the endowment funds appears to be the chief source of support, with private contributions being second. City, county and state, third, community chests, fourth, with very little income from paying patients. (The precariousness of the position of the hospitals in any period of economic stress is at once evident.)

Figures are not available which give costs of maintaining these institutions for any fiscal year. The per capita costs, however, for 1932 average \$4.82, which seems a reasonable figure.

The cost per patient per day varies from \$1.87 to \$9.21. In only two hospitals are the costs under \$3.00 per day. In ten hospitals the costs are between \$3.00 and \$4.00. In nineteen hospitals the costs are over \$4.00. In thirteen hospitals the costs are over \$5.00, in nine the costs are over \$6.00. In two hospitals the costs are over \$7.00, in one of these the cost per day is \$8.06 and in the other, \$9.21 per day.

The thirty three hospitals reporting total admissions show 98 773 patients cared for in 1932, or an average of 2,981. Again comparing the general hospitals with our group we note that the total admissions for 6,562 hospitals is estimated at 12,8151, so that our group admitted only 1.36 per cent of the total hospital admissions including children and adults.

Total admissions in the respective children's hospitals for 1932 varied from 949 to 7,914. Eight hospitals had total admissions under 2,000, three had admissions under 1,000, thirteen hospitals had 2,000 or more admissions, eight had 4,000 or more admissions, five had 5,000 or more, four had 6,000 or more and two had 7,000 admissions.

These children's hospitals admit patients from birth to sixteen years of age, the average being up to fourteen years. Twenty-one admit children over twelve years of age. In one instance the age limit for the orthopedic department is placed at twenty-one. All admit both colored and white children.

The total bed capacity of this group is approximately 5742, ranging from fifty to 350 beds in each institution. Twenty-nine have bed capacities of 100 or more. Twenty-one have 150 or more beds, thirteen have 200 or more beds, only four have over 250 beds and three have over 300 beds. The general hospitals have something over one million beds.

TABLE I

SUIT	PER CAPITA	AGE LIMIT	TOTAL ADMISSIONS 1932	TOTAL BEDS	DASHIN PTS	CRIBS	BEDS
1 FRN	4.07	12	3147	180	0	42	148
2 M Phys	6.09	14	4807	151	44	30	80
3 M Lay	6.710	21	2,082	265	18	28	119
4 FRN	3.92	14	6016	182	14	50	118
5 M Phys	0.21	15		637	16	10	34
6 FRN	4.78	13	4110	201			
7 M Phys	5.24	1	2744	140	14	86	--
8 M Lay	2.57	14	7093	357			
9 M Phys	3.88	10	3,580	342	10	80	232
10							
11 FRN	3.04	12	474	100		40	00
12 M Phys	6.35	14	1077	82	0	40	30
13 FRN	0.22	12	1,371	50	3	11	80
14 FRN	5.21	12	6687	732	50	40	212
15 FRN	3.12	12	6074	240	10	90	140
16 M Phys	3.85	13	7,914	101	12	14	108
17 FRN	1.87	10	2,500	168	12	90	00
18 FRN	0.08	14	3090				
19 FRN	3.50	14	4522	218	47	18	100
20 M Phys	9.21	13	2009	200	80	70	
21 FRN	3.25		2778	740	60	260	20
22 FRN	8.06	12	824	50	10	40	
23 F Lay	4.68	12	2068	109		17	92
24 M Lay	5.12	12	898	190		30	160
25 M Lay	5.392	15	1,908	110	0	27	83
26 M Lay	0.01	15	2415	220	5	40	181
27 M Phys	0.380	14	979	110			
28 FRN	3.08	14	2,584	100	12	40	42
29 FRN	4.69	12	2406	130		55	81
30 FRN	4.15	15	2680	190		42	154
31 FRN	3.09	14	1,288	132	7	18	107
32 FRN	7.48	12	3,710	155		55	100
33 M Phys	3.23	14	3,249	236	6	40	160
34		?	?				
35 M Phys	3.93	14	2,885	135	10	65	54

This number of 5,772 is divided into bassinets for the newborn, cribs for infants under two years, and beds. Roughly, there are 542 bassinets, 1,506 cribs, and 3,724 beds. Ten hospitals have no bassinets for medical cases.

As nearly as can be estimated, private rooms are 445 out of the total, less than 8 per cent. Wards predominate, and possibly as high as 60 per cent of the wards are divided into cubicles. These figures naturally lack accuracy owing to their being more than one bed in private rooms, beds not in use and conversion from one type of ward into another type of ward. These hospitals are variable in the use of their ward beds, as the need arises they are converted into contagious wards, observation wards, etc.

The following departments prevail: medical, surgical, orthopedic, neurologic, otolaryngologic, and contagious.

Out of twenty hospitals, nine report special wards for medical cases, twenty out of thirty three, special wards for surgical cases, fourteen out of thirty two, special wards for orthopedic cases, two out of thirty two, special wards for neurologic cases, thirteen out of thirty two, for otolaryngologic cases, eighteen out of thirty one, contagious departments, nineteen out of thirty two, observation wards. Special departments may often be created as the need arises. While many hospitals have contagious departments, they are largely used for contagion developing within the hospital.

Only two of the entire group accept all types of cases, all the others exclude certain diseases, such as contagion in general, smallpox, mental, active venereal, pulmonary tuberculosis, etc.

Academy News

The fourth annual meeting of the American Academy of Pediatrics will be held at the Wade Park Manor Hotel (Cleveland) and the Cleveland Medical Library, June 11 and 12, 1914.

Program

Monday June 11 9 A.M.—Round Table Discussion

Blood	Dr. Thomas B. Cooley
Acute Abdomen of Childhood	Dr. Herbert F. Coe
The Toilet Question	Dr. Isaac A. Abt
Adolescence	Dr. Borden S. Veeder
Heart	Dr. Hugh McCulloch
Vent. Infection	Dr. John A. Thomas
Newborn	Dr. Arthur H. Parmelee
Allergy	Dr. Bela Schick

Monday Afternoon June 11—General Meeting, Cleveland Medical Library
Identification Address

Address of Invited Guest

Arvid Wallgren (Göteborg, Sweden) (subject to be announced later)

Report of the Executive Board

Report of Secretary-Treasurer

Report of Regional Committees

Report of Special Committees

(Reports will be presented in mimeograph form to the membership)

Tuesday June 12 9 A.M.—Lunch Discussions, Cleveland Medical Library

Dental Caries by Dr. Frederick F. Tallall, Toronto, Ontario

Ductless Glands by Dr. R. G. Hoskins, Professor of Physiology, Harvard Medical School

(Assistants to be announced later)

Tuesday Afternoon June 12—Round Table Discussions

(Repetition of Monday morning)

General meetings will be held at the Cleveland Medical Library. This includes Panel Discussions on Tuesday morning. Round Table Discussions will be held at the Wade Park Manor Hotel.

Each man will be eligible for two Round Table Discussions, one on Monday morning, June 11, and one on Tuesday afternoon, June 12. No man will be assigned to the same Round Table Discussion twice. All Round Table Discussions will be limited to twenty-five members. No man will be listed for the Round Table Discussions unless his obligations to the Academy are paid in full.

Exhibits will be held on the main floor of the hotel in the ballroom. There will not only be commercial exhibits, but scientific and educational exhibits as well. Dr. Rahrlich will have an exhibit on poliomyelitis and it is likely that one other exhibit showing state work will appear.

The Wade Park Manor Hotel is situated well out from the center of the city, overlooking a beautiful park and within five minutes' walk of the library where the general meetings will be held. It is also close to the buildings of the Medical School of the Western Reserve University. It is accessible to all automobile roads coming in from the south and east, being but one block off the main road.

The annual clinical meeting of Region III of the American Academy of Pediatrics, will be held at Rochester, Minnesota, October 4, and Minneapolis, October 5 and 6

Dr Carl H Laws, 12 Pierrepont Street, Brooklyn, N Y, has been appointed State Chairman for New York to replace Dr Hugh Chaplin, who has resigned

The Indiana State Committee, through its Chairman, Dr O N Torian, has made the following report on activities in its state Dr Torian is a member of the Indiana Health Council and is Chairman of the Child Health Committee

The state organization consists of a health council cooperating with the State Board of Health and the Indiana Medical Association The Department of Child Health has been given over to this cooperating group to plan any program they see fit, for which they use the machinery already existing in the State Health Department and the organization of the State Medical Association

The following projects have so far been undertaken

1 Education of parents in child health—mothers by talks on child health by doctors The state society has urged the doctors to be prepared for this undertaking, and health organizations have been urged to request doctors to speak There has been a great deal more activity in this educative way since the present plan was adopted

2 Education of doctors by pediatricians by lectures delivered before county or district medical societies Much more of this has been done by pediatricians in this, the first year of the new organization, than ever before There is a committee looking into this matter and letting it be known to county societies

3 Immunization campaign against diphtheria and smallpox This was recommended by the health council The medical association published the advice to the doctors and urged them to vaccinate the indigent as well as those able to pay The health board placed free vaccine for the indigent with each county medical society There was strong objection from some sources, but in general the campaign was a decided success Above all, Indiana doctors are beginning to see the wisdom of doing their part in public health

4 The celebration of May Day is entirely in the hands of this cooperating body, and it is making all plans, using the county medical society as the responsible body in its county Since all plans are formed by the central body and all advertising, instruction, etc., comes from this source, it places Child Health Day entirely in the hands of the doctors of the state

The Indiana plan for child health is much like that of Illinois and Pennsylvania There is this difference—Indiana doctors have complete control of the department and have official power to initiate and control all projects

In such a scheme it will be difficult to get some county medical societies to cooperate and, as expected, some objection has been encountered here In general the county societies have adopted the projects as proposed and have done their work well It is believed that by continued persuasion, all will eventually see the advisability of falling in line and will realize the benefits to the profession in interesting themselves in child health

Dr M K Wylder, State Chairman for New Mexico, has made the following report for his state

Number of square miles in state, 12,634

Number of counties, 31

Number of physicians practicing in each locality showing area covered by each physician. It is impossible to answer this as most of our physicians are in the larger towns, and some are isolated 100 miles from any other doctor consequently the area covered by physicians in this state is extremely variable. There are approximately 310 active, practicing licensed physicians in the state.

Number of graduates of reputable medical schools. All physicians licensed since 1900 have had to submit diploma from reputable school so that only a few are not graduates of reputable schools. Two hundred fifty five are from high class school, and 91 from inferior schools.

Number of graduates having had no interne hip—not known. Location of those limiting their practice to pediatrics. Albuquerque — Santa Fe — Clayton, 1.

Number of various child welfare organizations in the state and the type of work they are doing. In six counties, Colfax, Curry, Dona Ana, Grant, McKinley and Santa Fe there are county welfare organizations employing a full time executive secretary who is a trained social worker. These workers all carry on a child welfare program. This program interest itself in all phases of children's work as it affects their social well being, the dependent, neglected and delinquent children, the physically or mentally handicapped, adoption, child labor and service to institutions caring for children. In the way of investigations before admittance to the institution and also the rehabilitation of the children in the communities when they leave the institutions. This same service is given to the counties not having trained social workers by the members of the field staff of the State Bureau of Child Welfare. The state and county offices render service to approximately four thousand children in our state each year. This does not include relief work with needy families where food, shelter, clothing, etc., is provided and where thousands of other children are directly benefited. The Bureau of Child Welfare is the only official organization but many organizations have departments of child welfare.

Pediatric Society—none organized.

Members of the Academy and their location. Dr. Stuart W. Adlor, Dr. M. K. Weldor, Albuquerque, N. M.

What the Academy is doing—nothing as yet.

Child death rate. Past ten years last two years—New Mexico was admitted to the registration area in 1929 and records previous to this are considered not sufficiently accurate for statistical purposes. You will note that the infant death rate is calculated per 1000 live births. Total death rate and infant death rate (under one year) are given for comparison.

YEAR	TOTAL DEATHS		INFANT DEATHS (UNDER ONE YEAR)	
	NUMBER	RATE (PER 1000 POPULATION)	NUMBER	RATE (PER 1000 LIVE BIRTHS)
1929	6160	15.8	1,584	140.2
1930	6,801	16.0	1,609	188.3
1931	5796	14.4	1,540	128.9
1932	5712	14.0	1,393	118.2
exclusive of Indians				

The following is a birth rate table (Both birth and death statistics are exclusive of stillbirths)

POPULATION		BIRTHS	
YEAR		NUMBER	RATE (PER 1,000 POPULATION)
1929	389,507	11,297	29 0
1930	394,863	11,996	30 4
1931	402,139	11,946	29 7
1932	409,415	11,786	28 8
1933	416,690	----	--
exclusive of Indians			

Cases of patients dying from diphtheria The following table shows the number of cases, the New Mexico rate and the U S rate —

YEAR	NUMBER	RATES (PER 1,000 POPULATION)	
		NEW MEXICO	UNITED STATES
1929	35	9 0	--
1930	51	12 1	4 9
1931	45	11 2	5 0
1932	84	20 5	4 5

NEW MEXICO POPULATION
(1930 CENSUS)

COUNTY	TOTAL	INDIANS	EXCLUSIVE OF INDIANS
Bernahillo	45,430	1,106	44,324
Catron	3,282		3,282
Chavez	19,549		19,549
Colfax	19,157		19,157
Curry	15,809		15,809
DeBaca	2,893		2,893
Dona Ana	27,455		27,455
Eddy	15,842		15,842
Grant	19,050		19,050
Guadalupe	7,027		7,027
Harding	4,421		4,421
Hidalgo	5,023		5,023
Lea	6,144		6,144
Lincoln	7,198		7,198
Luna	6,247		6,247
McKinley	20,643	9,562	11,081
Mora	10,322		10,322
Otero	9,770	708	9,071
Quay	10,828		10,828
Rio Arriba	21,381	1,556	19,825
Roosevelt	11,109		11,109
Sandoval	11,144	2,930	8,214
San Juan	14,701	8,170	6,531
San Miguel	23,636		23,636
Santa Fe	19,567	433	19,134
Sierra	5,184		5,184
Socorro	9,611		9,611
Taos	14,394	765	13,629
Torrance	9,269		9,269
Union	11,036		11,036
Valencia	16 186	3,224	12 962
Total for State	423 317	29 454	394,863

Approximate number of children immunized against diphtheria vaccinated with given typhoid vaccine. Record incomplete however in thirteen counties in the state during the past three and one-half years. Approximately 11,500 children were immunized against diphtheria. 17,880 children were vaccinated against smallpox. 3,200 persons immunized against typhoid.

Approximate age—unknown

Number followed up by the Schick test—unknown

Activity of health agencies throughout the state: Six counties have full time county health units, twenty-five counties have part time health officer. The activity naturally varies in each county depending upon the personnel of the unit, the appropriation, whether there is a nurse sanitarian, inspector, milk or drainage, etc.

Preschool and school health examination. Most of the county health departments make school health examination, and probably most of them hold preschool clinics and examine the preschool child. The activities vary depending upon appropriation, school nurse, county nurse, etc. In at least 50 per cent of the counties of the state both the school child and the preschool child are examined by the health units. The services of a public health nurse are furnished in twelve counties by the Commonwealth fund, these nurses are in counties where we have part time health officers.

Methods of caring for children having defects in those families unable to pay. This varies, some are handled through the Bureau of Child Welfare, others through local organizations, some counties have tonil and adenoid clinics for these children, others have dental clinics where the physicians and dentists donate their services. The American Legion, Red Cross, National Tuberculosis Association, women's clubs, Rotary Clubs, Masons, churches, and other organizations help defray the expense.

News and Notes

The annual meeting of the South Carolina Pediatric Society was held January 30 at Florence, South Carolina. There were about twenty five in attendance. Dr Alfred Shands and Dr Chris Johnson of Duke University were guests of the Society. Dr Shands exhibited a number of pathologic specimens in connection with his paper. Dr J I Waring, the president of the Society, addressed the meeting. The officers elected are: Dr J P Price, Florence, S C, President

Dr William Weston, Jr, Columbia, S C, Vice President

Dr L B Salters, Florence, S C, Secretary and Treasurer

The Society for Pediatric Research will hold its annual meeting in Atlantic City, May 1, under the presidency of Dr Rustin McIntosh of New York.

The American Pediatric Society will hold its annual meeting at Grove Park Inn, Asheville, N C, on May 3, 4, and 5, 1934, under the presidency of Dr Charles A Fife of Philadelphia.

Errata

Because of the number of requests for information, attention is called to a printer's error in spacing of the width weight tables as published on pages 612, 613, 614, 615, in the article, "Determining Appropriate Weight for Body Build," by Helen B Pryor and Herbert R Stolz in the October, 1933, number of THE JOURNAL OF PEDIATRICS

All odd numbered ages should be shoved down on the height scale as follows

For girls—

Age 7 should begin at height 40 inches

Age 9 should begin at height 45 inches

Age 11 should begin at height 48 inches

Age 13 should begin at height 53 inches

Age 15 should begin at height 57 inches

Age 16 is the boys' table and does not apply to girls

For boys—

Age 7 should begin with height 41 inches

Age 9 should begin with height 45 inches

Age 11 should begin with height 49 inches

Age 13 should begin with height 52 inches

Age 15 should begin with height 56 inches

Correct tables may be had of the author on request

In Dr Francis Scott Smyth's critical review, "Allergic Diseases," in the March, 1934, issue of the Journal, p 414, the sentence beginning on line 24 should read

"It is strange, however, that no mention was made of the work by McNair in this field, which the reviewer feels is fundamental"

Comments

A Message From the President

THE American Academy of Pediatrics is progressing. It is growing in size and strength; its aims and purposes are becoming more clearly defined, and there seems to be no doubt but that it will continue to fill an important place in American child welfare, pediatric teaching and practice. As must be expected, there are wide differences in the activity of the Academy in the various localities. In some places it is an active going concern, plunging into the midst of the many problems which confront a pediatricist. In others it is dormant and needs awakening. Two things are of extreme importance.

The first is that it should be our aim to include every qualified pediatricist in our ranks. This year the initiation fee has been lowered for twelve months because of the depression which has weighed heavily on the medical profession and it has on those in all walks of life—though perhaps a little more heavily on a few. Every member should feel himself a special agent to enlarge the membership. Each one should do his part in this and not wait for some one to tell him. If the membership in your state is not yet enough to whose fault is it? Ask yourself if you have been doing your bit and if you have not get busy.

The second is that in each state the members of the Academy should get together and decide what needs to be accomplished and what action can be taken. If the Academy is not active in your part of the country, do your part to start the ball rolling and do not wait for some one to step on the accelerator. Unfortunately many people are not equipped with self-starters, but it is assumed that every member of the Academy is, or he would not be a member. Do not sit idly by and complain that the Academy in your state is accomplishing nothing. If it is not getting ahead it is because you are not taking the interest that you should.

The Academy is your organization; it does not belong to the officers or the various state chairmen, but to the members as a whole and to each one as an individual. Everyone in it should feel a personal sense of responsibility and a personal pride in it and its work. Don't start out with an "if" or a "but" however much you may like to complain. If things are not right, consider yourself a committee of one to find out why they are not, and then consider yourself a committee of one to see that they are righted. Get together with your fellow members in personal conference or by mail, and get things going as they should be.

In some sections the enthusiasm is very great and many activities well under way; in others there has been a disposition to lag and await a leader. The state chairmen cannot do everything single-handed. Help them and let them know that you are ready and willing to help. Seek them and do not wait for them to come to you.

It is important that the conditions in each region and in each state be known. What might suit New Jersey very well would be entirely useless in Idaho and so on. May I suggest a study of the following: the extent and nature of infant welfare work, the extent and quality of kindergarden work, especially free

kindergarten activities, extension instruction for practitioners, particularly in rural districts, the number of hospital beds for children and the dispensary services for children, also the amount of abuse of free privileges in these, the amount of public instruction in the care of children's teeth, preventive pediatrics, nutrition and kindred topics, and whether such instruction is sending children to the free services when the parents are able and often willing to pay. Some of these subjects are being studied on a nation wide scale, but most of the information must be supplied by the members of the Academy for their various localities. Again let me urge you to do your part without further solicitation. Only in this way can the Academy function for the benefit of all.

May every member of the executive committee, every district chairman, and every state chairman come to the Cleveland meeting with a report of progress, and let every member see to it that the reports are good ones.

JOHN RUHRAH

IN "News and Notes" for last month an announcement appeared regarding the American Board of Pediatrics, which is of importance to all pediatricians. The Board was formed by the three national pediatric societies, and in this sense is the agent or servant of the societies. The success of the Board will in large part depend upon the backing and support of the membership of these societies. The sole function of the Board is to certify to the competency of physicians to practice pediatrics as a specialty. Determination of competency is based on adequate training and experience. For a period of two years pediatricians of ten years or more of specialization may, on the option of the Board, be certified on record. An examination is required of all others and, after two years, of the above-mentioned group. Plans for regional examinations will be announced in the near future. The mechanism for setting up examining boards is a difficult and complicated one in view of the experience of other specialty examining boards which have been at work for a number of years.

While the immediate value of a "certificate" to the established specialist of today may seemingly be of minor importance, the necessity of establishing standards and requirements is obvious to every one. The Academy of Pediatrics is one of the sponsoring groups, and its membership should stand behind and make every effort to support the work of the Board. The Board has placed a fee of \$20.00 for certification in view of the present economic conditions. The fee for three of the established boards is \$50.00 and \$35.00 for the fourth. No member of the Board may receive any salary, bonus, or emolument of any kind. The entire fee goes to the work of the Board including the publication and distribution of lists of licentiates.

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A. J. M. TREACY, M.D., in
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The Journal of Pediatrics

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Vol 4

JUNE, 1934

No 6

THE JOURNAL OF PEDIATRICS

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In discussing the treatment of decomposition Feer says "The period of repair may be shortened by giving suitable additional food the best, probably being buttermilk to which carefully regulated proportions of dextrin and maltose preparations or malt soup are added. —E Feer *Text Book of Pediatrics*, J B Lippincott Co., Phila, 1922 p 284

In the treatment of infantile atrophy, Fischer recommends the following "The carbohydrate should be increased by gradual addition of dextri-maltose

"Malt soup or dextrimaltose (Mead's) should be added in teaspoonful or more doses to each feeding until the point of carbohydrate tolerance is reached. —I Fischer *Diseases of Infancy and Childhood* F A Davis Co Phila, 1925 1 1, p 287

Grulee discussing treatment of decomposition, observes "As a rule it is best to start with 2 to 2½ or 3 ounces of albumin milk to the pound weight in 24 hours the sugar to be added is in the form of a maltose-dextrin mixture. One should never delay too long in adding this. —C G Grulee *Infant Feeding* W B Saunders Co, Phila 1922, p 265

Referring to the hypotrophic infant Herrman writes "In mild cases the addition of dextrimaltose instead of cane or milk sugar may be sufficient to obtain a gain in weight. —C Herrman *The treatment of nutritional disorders in artificially fed infants* New York M J 114 158-160 August 1921

In discussing artificial feeding in atrophy, Hess states "The carbohydrates are usually added in a slowly fermentable form such as the maltose and dextrin compounds, which are usually started by the addition of four grams per kilogram (1/15 ounce per pound) and increased until eight grains or more per kilogram (¼ ounce per pound) of body weight are added. —J H Hess *Feeding and the Nutritional Disorders in Infancy and Childhood*, F A Davis Co, Phila, 1928, p 278

Concerning the treatment of marasmus Hill says "When the stools have become smooth and saive-like carbohydrate in the form of dextri maltose, may be gradually added up to the limit of tolerance. —L H Hill *Practical Infant Feeding* W B Saunders Co Phila 1922 p 281

A spasmophilic baby on bottle feeding should receive a limited amount of milk—a pint, or at the most 24 ounces in the 24 hours—to which cereal gruel and some form of sugar is added preferably one of the malt dextrin preparations also the early addition of other foods than milk to the baby's

diet' —W Lampolis *Infantile spasmophilia Interstate M J* 25 612, Sept, 1918, abstr *Arch Pediat* 57 691, Nov 1918

With reference to the treatment of diarrhea Lust writes "After several days 2% to 3% of a maltose-dextrin preparation may be added (Dextri Maltose) This is preferable to the easily fermentable lactose or cane sugar —F Lust *The Treatment of Children's Diseases*, J P Lippincott Co., Phila 1930 p 155

"The treatment of artificially fed children in the first of these groups consists in putting them on a low fat diet and giving them carbohydrate in the form of one of the less fermentable sugars—e.g. dextrimaltose. —I G Pearson *Feeding disorders of early infancy*, *Lancet*, 1 687-693 April 6, 1924

Pearson and Willie in discussing the treatment of milder cases of inanition say "Regulation of this disturbed organismal balance is obtained by the addition of carbohydrates while fat and casein are reduced. For this purpose dextrimaltose and flour are better than the ordinary sugars since they are more slowly absorbed and have greater efficacy in their powers of controlling the flora in the large intestine. —H J Pearson, and H G Willie *Recent Advances in Diseases of Children* P Blakiston's Son & Co Phila, 1930 p 116

Regarding the treatment of the marantic infant Raue states "After the intolerance to sugar has been overcome a carbohydrate, preferably Dextri maltose may be added. —C S Raue *Diseases of Children* Boerche & Tafel Phila 1922 p 427

In discussing the treatment of atrophy, Thursfield and Paterson state "If the baby continues to improve the next step in the treatment is to add to the milk one of the less fermentable carbohydrates such as dextrimaltose. —H Thursfield and D Paterson *Diseases of Children*, William Wood & Co 1929, p 107

"I also find dextrin maltose an excellent addition to albumin milk when the first object of that food has been achieved and a gain in weight is desired in this way I have succeeded in feeding albumin milk far beyond the period usually advised, with highly gratifying results. —F L Larchenhem *Infant Feeding, Its Principles and Practice* Lea & Febiger, Phila 1915 p 158

Dextri maltose has been substituted for lactose not infrequently when the tolerance for the latter continues low. —J H West *Low fat, high starch evaporated milk feeding for the marasmic baby* *Arch Pediat* 48 189-190, March, 1931

"Malt sugar is indicated when others fail to produce sufficient gain or when emaciation of fat is evident. —O H Hill in *The role of carbohydrate in infant feeding* *Santhorn M J* 11 177 March, 1918, abstr *Arch Pediat* 25 347 July 1918

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¹⁻³ Bibliography on request.

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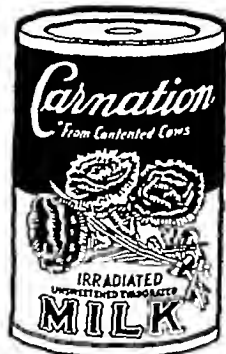
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Q—Have the average results obtained by you in feeding S.M.A. been excellent, good, fair or poor?

A—Excellent 74.2%
Good 25.8%
Fair 0%
Poor 0%

Q—Do you feel that S.M.A. is of value to you in your practice from the standpoint of preventing nutritional diseases?

A—Yes 97.1%
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Q—Has the feeding with S.M.A. been easier and less annoying than with other foods or mixtures used by you heretofore?

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If you are interested in saving yourself exacting detail in infant feeding and want to be assured of excellent results in most cases you can do no better than prescribe S.M.A., the formula prepared with laboratory exactness for infants deprived of breast milk.

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- 7 Curds produced by the action of the gastric juices on S.M.A. are soft and practically the same as breast milk.
- 8 Stools are acid and also physically similar to those of breast fed infants.

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S.M.A. is a food for infants—derived from tubercles tested cows' milk, the fat of which is replaced by animal and vegetable fats including biologically tested cod liver oil, with the addition of milk sugar, potassium chloride and salts, altogether forming an antirachitic food. When diluted according to directions, it is essentially similar to human milk in percentages of protein, fat, carbohydrates and ash in chemical constants of the fat and in physical properties.

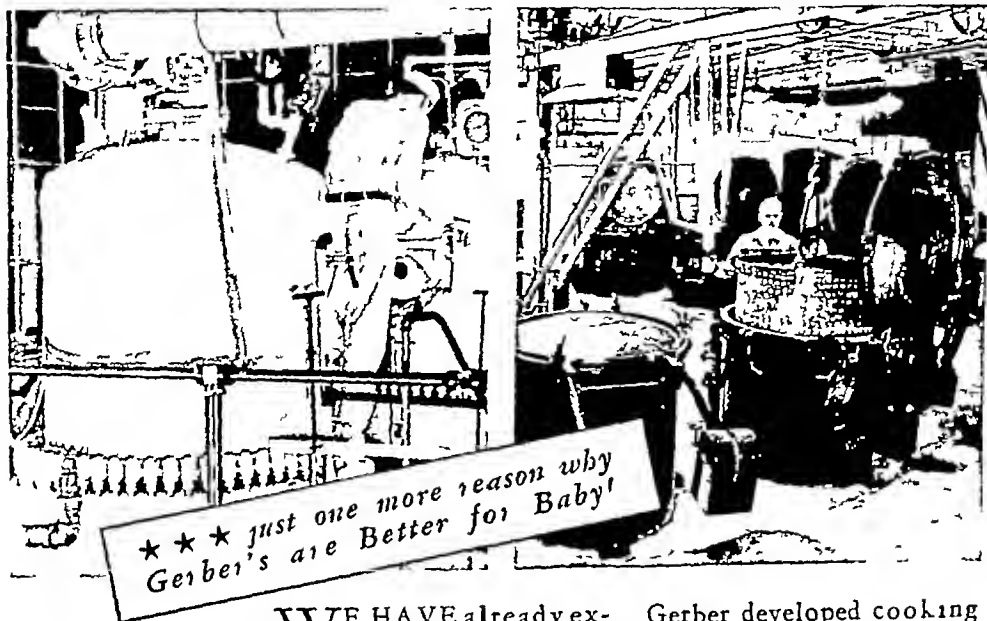


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S M A PRODUCES RESULTS, MORE SIMPLY AND MORE QUICKLY

★Cooking under steam pressure keeps the vitamins in



★★★ just one more reason why Gerber's are Better for Baby!

WE HAVE already explained what super-care in every detail goes into the preparation of Gerber products, from seed and soil selection and planting until they are ready for cooking.

Now let us tell you about what is perhaps the most important single advance in Gerber methods. It is the equipment that, from start to finish of the cooking process, maintains a blanket of steam which excludes air from contact with the product.

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Strained Tomatoes	Green Beans
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MALTOSE AND DEXTRINS**

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• Since certain proteins are frequently the cause of eczemas and other forms of allergy it is desirable to eliminate these offending proteins from the infant diet. Cereal proteins are frequently present as contaminants in some milk modifiers. The routine use of a protein free carbohydrate in all milk modifications should help to diminish the incidence of these troublesome eczemas. Alerdex is a protein free carbohydrate developed by our Research Division to meet this need and the demand for it is steadily increasing.

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Moisture	3.0
Ash	0.3
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Reducing sugars as maltose	50.0
Dextrins (by difference)	45.0
Level tablespoons per ounce	4
Calories per level tablespoon	27½
Calories, per ounce	110



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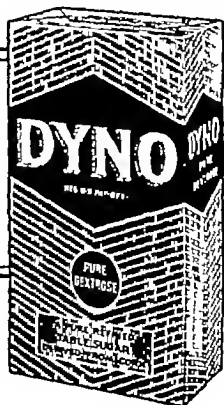
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It is natural that doctors who continually emphasize the curative effects of air and sun the benefits of lightweight bulkless protection should enthusiastically endorse this new diaper. Developed by the leading manufacturers of surgical dressings it is made of an entirely new type of fabric—a loose open porous weave that is much lighter much less bulky yet 30% more absorbent. It allows free

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Please send me a test sample Curity Layettecloth Diaper

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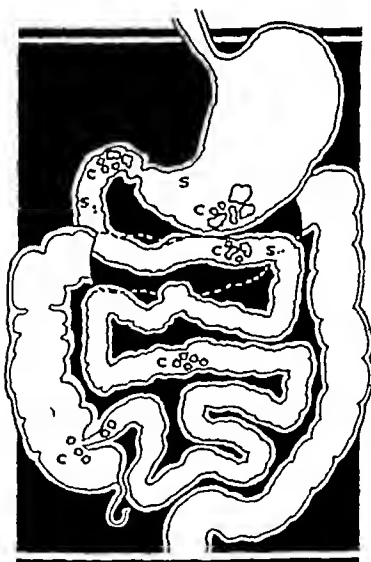
CURD TENSION

- AND INFANT FEEDING -

ITS · EFFECT · UPON · THE · ASSIMILATION · OF
FATS



BREAST MILK SIMILAC MILK POWDERED MILK COW'S MILK



C—Cow's milk S—Similac
Schematic drawing of the relative size of the curds of cow's milk and Similac vomited by six weeks old puppies after one-half hour's ingestion

"**F**AT has a caloric value more than twice that of either carbohydrates or protein and serves very well to make up the necessary energy or caloric requirement. Two of the important vitamins, 'A' and 'D', are associated with the fat of milk and when the diet is low in milk fat these vitamins must be supplied in some other form"¹

"When milk curdles in the infant's stomach it entangles a large proportion of the milk fat in its meshes and only such fat as lies near the surface of the curd can be reached by the digestive juices. The amount of fat in the curd depends upon the amount of fat in the milk"²

The soft, fine curds of SIMILAC, which register zero on the tensiometer, expose a greater surface area for the digestion of the fat than do the large, tough curds of fresh cow's milk.

The finer the curd the greater the surface area. The greater the surface area the more exposed are the fats, carbohydrates, proteins and salts to the digestive enzymes. Result—a more complete utilization of the food elements.

¹Marriott Infant Nutrition, pg 49

²Talbot Morse and Talbot, Diseases of Nutrition and Infant feeding, pg 48

Samples and literature will be sent on receipt of your prescription blank.

SIMILAC—Made from fresh skim milk (casein modified); with added lactose, salts milk fat and vegetable and cod liver oils

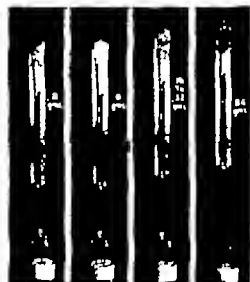


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CURD TENSION

- AND INFANT FEEDING -

ITS EFFECT UPON THE ASSIMILATION OF CARBOHYDRATES



BREAST MILK SIMILAC POWDERED MILK COW'S MILK



C—Cow milk S—Similac
Schematic drawing of the relative size of the curds of cow's milk and Similac vomited by six weeks old puppies five one-half hour ingestion.

THE curds of milk contain only a small amount of carbohydrates, sufficient however to be a disturbing factor in infant feeding.

"A large part of the digestion and absorption of the carbohydrates takes place in the upper part of the small intestine."

"The disaccharides, maltose, sucrose and lactose, are converted into monosaccharides through the action of enzymes secreted by the small intestine and are absorbed in the form of monosaccharides."

"When absorption is impaired, some sugar may reach the large intestine and here be attacked by the bacteria present. Sugar itself rarely appears in the stool, it being decomposed to form acids and gases."

The large, tough curds of cow's milk are more slowly disintegrated and thus more slowly release the encased carbohydrates than the soft, flocculent curds of Similac.

The disintegration of the curd of cow's milk may not be completed until after the curd, with the encased carbohydrate has passed that portion of the small intestine where the enzymes for the conversion of disaccharides into monosaccharides are present. There is not this possibility when Similac is fed because the fineness of the curd of Similac does not permit of the encasement of carbohydrates to any extent.

The finer the curd the greater the surface area. The greater the surface area the more exposed are the fats, carbohydrates, proteins and salts to the digestive enzymes. Result a more complete utilization of the food elements.

¹ Loewen & Paley: *Journal of Physical Chem.* 1904, XLIX, 322.

² Marriott: *Infant Nutrition*, pg. 81.

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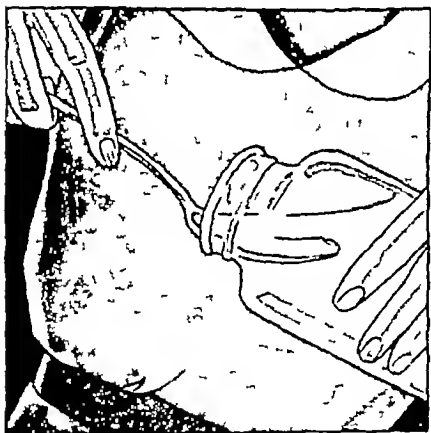
SIMILAC—Made from fresh skim milk (casein modified); with added lactose salts, milk fat and vegetable and cod liver oils.



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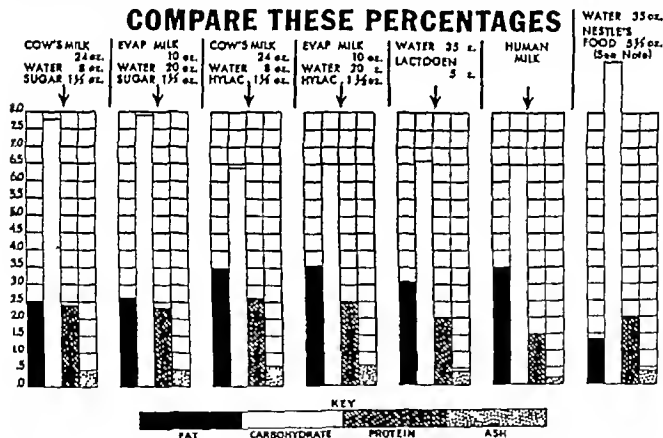
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THE JOURNAL OF PEDIATRICS

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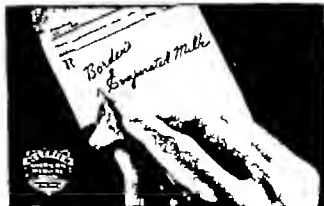
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The Journal of Pediatrics

Vol. 4

JUNE, 1934

No. 6

Original Communications

TRENDS IN PEDIATRICS

PRESIDENTIAL ADDRESS, AMERICAN ACADEMY OF PEDIATRICS

JOHN RUHAÄH, M.D.
BALTIMORE, MD

YOU must permit me to express my thanks and appreciation for the honor which you have conferred upon me in making me your president this year. As I remarked on taking office my predecessors owed their selection to certain outstanding achievements in pediatrics, while it seems to me that my being chosen depended largely on my having good friends on the nominating committee or on the fact that last year was a good year for "polio" presidents.

My predecessors devoted large portions of their addresses to a consideration of the aims and needs of the Academy but now owing to their labors and those of our efficient secretary there is not as much need for this as there was and I may call your attention to some other things which I think at once of interest and importance. These thoughts I have grouped under the heading of Trends in Pediatrics.

Our knowledge of the diseases of children their prevention and management has been the matter of slow growth during the past ages of which we have any record. Folklore popular superstitions and a certain amount of crude clinical experience furnished the first pediatric literature. From time to time some brilliant and observing mind added clinical facts of great importance. Hippocrates in his Aphorisms and in his description of mumps in Thasos and of epidemic paraplegia are a good example of this and Soranus of Ephesus with his incomparable treatise on the diseases of infants, is another.

Apart from these occasional flashes of genius, which for the most part made little or no impression on the actual practice of medicine as it applied to children, pediatrics like medicine just drifted or shall we

Presented at the Fourth Annual Meeting of the Academy of Pediatrics, Cleveland, Ohio, June 11, 1934.

say, flowed willy-nilly here and there and the professional interest in the early days, as now, was largely a reflection of what was uppermost in the lay mind

What is meant by pediatric trends is, perhaps, best illustrated by a simile, an almost allegorical one. We can imagine the knowledge of pediatrics as a flood of water, moving like a river through the varied panorama of the ages, no two eras of which are alike, but there are in all certain general similarities. The physicians who have interested themselves in pediatrics are like mariners voyaging for a brief period on this flood and their books and writings may be likened to the stories of travelers who have set down an account of their wanderings and deeds. Each one of these hardy explorers finds a new spring and releases a pent-up rivulet of water which, mingling with the current, increases its volume, sometimes it is a stream of crystal beauty and other times only a muddy flow which clouds the flood. Alas, too many of the contributions have done this, but fortunately this mud quickly sinks to the bottom and does only temporary harm or else is forgotten long since unless some curious searcher delves in the detritus of the past. Still some of it may cling as tenaciously as viscid mucus. Only recently a physician of nation-wide notoriety wrote in one of his books that smallpox, eczema, and other skin eruptions were only evidence of nature getting rid of an impurity, an idea hoary with age.

The old mariners, like those of today, each must build a ship. The primitive pediatricists fashioned crude vessels, and their counterpart is seen in the household and quack medicine of today, and this not confined to out-of-the-way localities but is just as prevalent in cities and among those whose education should make them know better. From these crude beginnings of small unhandy vessels sailed in tiny rivulets of very muddy water, there gradually emerged bigger and better ones traversing an ever increasing stream of pediatric knowledge, flowing always, as it always will and must, with the general current of medicine, but to the seeing eye and understanding brain as distinct and separate as the gulf stream in the ocean.

Rarely does the mariner build an entirely new vessel, most often he takes an old one and puts in a few patches of his own and finally thinks the whole thing is his own creation. But the bystander sees only a conglomeration from many previous vessels, pieces of bronze and copper from the ancient days as good as when they were fashioned. Here a bit of carving from some old oriental ship, here a bit from ancient Egypt, something from Alexandria, much from Greece, all molded and fitted together. And later on someone will wreck this vessel, and others seize the most durable and imperishable bits and so on until we reach our present day, with its magnificent vessels, full of ingenious instruments

to aid navigation and make it easy. But these vessels sail the same waters charted better indeed, but still a flood flowing into the unknown ages to come.

Many contributors have released clear lupid streams like those set free by Hippocrates, by Soranus, by Aretaeus, or by Archigenes. But it must be borne in mind that each contributor while he added to the stream of knowledge, did little to change its direction. It flowed on and on like water, taking the way of least resistance and colored and altered by the country through which it passed. As the age varied, so varied pediatric thought. This is the important thing. The contributor reflected the age he lived in, the prevailing philosophy of his time. If Hippocrates saw clearly and wrote scientifically, it was because it was the fashion of the Greeks of his time to do so. He may have excelled his brothers in skill and technique, but had he lived in a different age it is to be doubted if he would have written as he did.

It has been said that Galen spoke and medicine stood still a thousand years. It did not stand still because of Galen, but because the stream of medical knowledge had flowed into the great intellectual swamp of the so called dark ages when men's minds were turned to other things than knowledge. It was an age highly colored by the church and St. Jerome was preaching, "He who has been bathed in the blood of Christ need never bathe again." The people of that age took him literally. Imagine trying to launch an infant welfare campaign when filth was a badge of piety and disease and plagues were regarded as scourges sent by the Almighty in punishment for the sins of His people. It would have taken a hardy man nay a foolhardy one to have tried to persuade these people that plagues could be stopped by killing rats and vermin. It would have been impious to have interfered in such a manner. If it was the will of God, then what was needed was prayer, intercessions for mercy, processions of holy relics and candles burnt before the images of the saints. Small wonder that science and hygiene languished and that pediatrics sank to a very low level or ceased entirely.

While pediatrics at this time practically disappeared in Europe except for fragments of Galen such as the *Liber de passionibus puerorum Galeni*, it still flowed through the Byzantine empire where the encyclopedists carefully garnered the wisdom of the ancients and added bits of their own, such as the work of Oribasius on that vexing subject, the upbringing of children. Thence the stream flowed through the Near East and the Arabians, Averroës, Avicenna, and the others tried to bring order out of chaos, and Rhazes separated smallpox from measles. It all seems very simple now, but many are the obscure problems of today which will seem childishly simple tomorrow when some clear head has solved them.

With the renaissance, when the plague had purged Europe of half its population and relieved the more intelligent part of the incubus of maintaining hordes of helpless and hopeless humanity, men's minds were freed and science in Europe again moved forward. The stream of pediatric knowledge which had stagnated there like water in a dismal swamp again began to flow. It was an age of authority. The church spoke for theology, and heretics were burnt at the stake, various rulers represented the body politic and were equally as ruthless, Hippocrates, Galen, the Arabians had supplied medicine with dogma and creed, and no physician thought of questioning their authority.

Then the reformation and an age of doubting and questioning, and men again began to think for themselves. Here again the spirit of the ages, as it always has and always will, dominated pediatrics. There is small need to speak of details. There came an age when astrology was one of the chief interests of man. The astrologer was more important at the birth than the midwife. Ballonius, who has been called the first modern epidemiologist, and who described whooping cough, was under its influence. How great a part the stars played in man's destinies may be had from the story of the queen of France whose bedroom in her chateau in Tonnerre communicated with that of the king's astrologer by a winding staircase. The king did not look with favor on the arrangement and informed the astrologer that on the morrow he would have him beheaded. "Sire," smilingly, bowing low, said the astrologer, "to do your bidding is my duty and pleasure, but last night I again read your horoscope and the stars say that you will die the day after I do." The astrologer was not beheaded. It makes little difference whether this story is true or not, it shows how completely the popular intellectual vagary of the age controls men's thoughts and actions, so that we seem scarcely more than puppets pulled by unseen wires.

The pediatric stream became more and more manifest. Ingrassius in Italy, Michael Doering and Sennert in Germany and Sydenham in England described scarlet fever, the latter added chorea, Richard Mead, chylous ascites, Ghisson, rickets. These and many other things became a part of the pediatric knowledge. Other streams which joined the main flow quickly disappeared because the time was not ripe.

The mortality bills of London showed the need for infant welfare and those hardy eighteenth-century pioneers in this field, Thomas Coram, William Cadogan, George Armstrong, and Jonas Hanway, launched the idea, but it came to naught—just as did the campaign in the first decade of the nineteenth century. The whole thing had to wait until the twentieth century, and some of the most important work in this line has been done by members of this Academy.

Peter Camper's idea of the rats and plague fell on deaf ears. Walter Harris cured tetanus with crabs' eyes, which were almost pure calcium,

but no one heeded Lind's discoveries in regard to scurvy waited a century before they were put to general use. Doctors let blood, purged, vomited, sweated, and dosed their patients with extraordinary messes of drugs and filth until Heberden with ridicule forced the latter out of the British pharmacopeia and Hahnemann unwittingly did humanity a great service through his high potency dilutions by showing the natural history of disease uninfluenced by drug interference—and some such revelation some day may be needed in reference to the natural history of disease and surgical interference even if the need be one of far less degree.

This subject might be pursued in greater detail but it has been shown that pediatric knowledge and progress is the product of its environment in any age. We have no better brains than our predecessors, but we live in an age of scientific discovery and of the practical application of what we have learned, the enormous progress of the past half century has been due to this. Without modern chemistry and physics we had remained at a comparative standstill. We sail the flood in magnificent vessels but this golden age of science will certainly undergo an eclipse, perhaps at no distant date.

The history of human progress is a mere repetition of what has happened. Politically man seems incapable of learning anything. As Byron phrased it

This is the moral of all human tales
'Tis but the same rehearsal of the past
First Freedom, and then Glory—when that fails,
Wealth Vice Corruption—Barbarism at last
And History with all her volumes vast
Hath but one page

While this is true of the social life of man it is not true of science. This is a new tale as yet but scarce begun each new chapter is more fascinating than the last and we have seen it begin, to use an Oslerian phrase, to make a new heaven in medicine and a new earth in surgery. On the shields of two great American universities are the words *Veritas*, "Truth and *Veritas vos liberabit*, 'The truth will make you free.' But we must remember Pitagoras question. What is truth? Does any one know?

Many loved Truth and lavished life's best oil
Amid the dust of books to find her,
Content at last, as guerdon of their toil,
With the east mantle she had left behind her

And humanity seemed no better off than it was before. But with the practical application of science we have seen the desert made green, terrestrial space all but annihilated, and one disease after another rendered harmless or made to disappear—and we have just begun. This

is not a repetition of wars and famines but a new chapter in history. Man for the first time in the annals of the race has attempted to shape his destiny. He still wallows politically, but we have seen what persistent intelligent effort has accomplished in sanitation, in the changing death rate and have noted the corresponding change in the birth rate, perhaps a natural compensation and not due as much to contraceptives as some would have us believe.

That man can accomplish great things regarding disease has been demonstrated. It remains to be seen whether he can successfully apply what he knows to political and social life. With this in mind we may well ask ourselves if by taking thought we may direct the trend of pediatric progress. It seems doubtful but it is a fascinating subject. We must remember that no large movement designed to benefit the human race has ever done that, it always does the opposite or is at least attended with obvious disadvantages. Prohibition, which was to empty our jails, increased them and brought in the dubious advantages of racketeering and kidnapping. The child welfare movement, admirable as it is, has increased the number of the unfit, idiots, imbeciles, low-grade morons and those who transmit the hereditary diseases. So far it has been a matter of quantity, and in this curious age with science and sentimentalism blended, it is difficult to imagine that anything can be done about it. We send the flower of our youth to be killed in battle by the hundreds of thousands with the greatest patriotic fervor and enthusiasm but contemplate with horror any movement to combat the perpetuation of idiocy and unfitness. Eugenics as it deals with proper mating is a method which cannot be looked to as practical. It resembles gambling with the genes, those curious many-sided dice which Fate shakes and casts from her jewelled cup, and we poor mortals are but the sum of each fateful throw.

We have in sterilization, however, the opening wedge for the solution of the problem of the unfit and undesirable. This is no new idea. It has been toyed with by various states and countries. It might prove ineffectual, it might bring worse evils in its wake, but that does not seem probable. Germany is embarking on this experiment. Unfortunately most of us shall not live long enough to see its results, but it would seem to be a logical step to take.

Birth control is used extensively by the so called better classes, or some unknown force is lessening the production of babies in what, according to our worldly standards, are regarded as desirables, while the obviously unfit go on breeding after the manner of guinea pigs. Leaving out this suggestion of sterilization, there seems at present no solution of the problem of the unfit. The obvious one is, of course, impracticable in this age, we are too far removed from Sparta. Since we have made quantity production and the maintenance of human life

a possibility, it would seem our duty to consider raising the quality. In this era when a dwarf behind his machine can do the labor of ten thousand or a hundred thousand men, there is small need for those who furnish only muscle created energy or less. Freed from the burden of the mentally unfit a vast wealth and energy could be utilized in improving the condition of the fit and who knows but that science, replacing clumsy political directed destinies of nations, might even tually lead to something more than the weary round, the censeless repetition, of known and prediatable disasters.

Let us turn for a moment to nearer and more homely subjects. There are other things about which it might be well to say a word. One is the comparative waste of the younger graduates in medicine doing research work. Investigators are born not made. Most internes doing research would not recognize a new thing if it came within their ken. True they may do the drudgery of detail for such of their chiefs as are more considerate of their own achievements than of the welfare of their students. In my humble judgment their time could be employed more profitably in getting a knowledge of practical pediatrics, leaving research to those fitted for it.

In our devotion to the science of pediatrics we are liable to forget that it is also an art. The earlier pediatricists were all art and no science and our present-day graduates are apt to be all science and no art. It is useless to know that a child should be operated on for appendicitis if you cannot quickly and easily convince the parents of that fact. We all know of instances when an appendix ruptured and what might have been a simple matter turned into a tragedy because the medical man in attendance could not present the matter clearly and convincingly. We have heard men remarking in the presence of an alert but very ill child "If she lives until morning etc., etc." The healthy doctor who has never known what it is to hang on every syllable the physician utters cannot realize what hours of needless suffering parents and the older patients undergo from careless thoughtless utterances. In spite of all the efforts made to popularize medical knowledge the average layman knows about as much about it as he does about Sanskrit roots. They nod intelligently and then usually get it all wrong. There should be two professors of pediatrics in every medical school one to teach the science and one to teach the art. In occasional instances one man can do both, but rarely.

The student who is to be a practitioner and most of them will be, is only too often trained in methods which belong to investigation.

The mass of facts already accumulated on pediatric topics is enormous, and the human brain could not contain them all, even granting the busy doctor had time to read the requisite number of pages. What is needed is a method of sorting out knowledge and presenting it

succinctly This is today an unsolved problem To illustrate what is meant, your attention may be called to the fact that the literature of poliomyelitis has been reviewed and over 8,000 good articles indexed by the International Committee Thus by no means includes all of it As the old saying has it, one cannot see the wood for the trees, and much precious material is buried and so lost As early as 1867 Charles Favette Taylor published a little book containing all the essentials of the management of this disease with a view of preventing deformities and protecting muscles, methods which applied intelligently would reduce the handicap of bad crippling from some 50 per cent to perhaps in the neighborhood of 15 per cent These methods have been echoed by others but there is scarcely a textbook in which this part of the subject is mentioned much less adequately dealt with This is true, but perhaps not so vividly so of many other conditions How to reduce the vast mass of pediatric literature to a usable, practical size is a problem worthy of our most eminent endeavor, and this done how to make the practitioners of pediatrics consult it is another, and how the practitioner may acquire or be granted the power to speak with the tongue of men and of angels and so persuade his clientele is still a third problem There is really no need for any child to die of diphtheria or of typhoid fever or of smallpox We know that efforts have been made to enlighten the public and some progress has been made, but we are far from accomplishing what we ought, and here the fault is apparently not that of the profession but of the public, dear, stupid, lovable, ignorant, human nature

Another subject of importance is the health of school children, much has been accomplished but it is only a very small fraction of what ought to be done Sixty, or even 70 per cent of the school children of today have faulty posture This could in a large measure be remedied by proper medical supervision and properly applied physical therapeutics, which in the larger schools might be done in groups But the mere mention of spending any more money on the schools raises a howl from many sources and much mention of "frills" and editorials in leading newspapers about getting back to the little old schoolhouse with the "Three R's"

Now a few words about the immediate problems of the Academy It is your organization, and its success depends on the Fellows and the State Chairmen who must inspire and direct the work The Academy is a departure from the usual medical society We do not aim at ordinary meetings although we hope to make the time spent at them pleasant and profitable What we are aiming at is an organization of pediatricists which can cooperate with all the existing agencies dealing with child welfare and make a determined effort to have men trained in pediatrics, either direct or advise with the directors of all

such organizations so that this work the importance of which is becoming more and more manifest, may be led by pediatricists, not by lay men, whose information, experience and vision are often lacking no matter how good are their intentions

State medicine is looming large on the horizon and only by a determined effort can the work in pediatrics be kept in the control of men who have devoted their lives to this subject and not turned over to professional politicians and uplifters. We feel that private practitioners can work hand in hand with health departments, and so limit the spread of the paternalism, which is sending to clinics patients who need not go there

The Academy aims to foster adequate hospital accommodations for children, and to this end is acquiring accurate information of conditions all over the country, it will not be long until definite recommendations may be made in this direction. We hope to point out the communities in which facilities are lacking and to further the extension of such accommodations. The members of the Academy should take an active part in milk supervision, medical inspection of schools, the health in schools, they should act as advisers to parent teacher associations and other social agencies, give public instruction on the radio and educational talks

There should be more cooperation between pediatricist and obstetrician every living in department or institution should have adequate pediatric officers to supervise the infants from birth

The Academy should also determine which communities are lacking in properly trained pediatricists and make every effort, through something similar to university extension work to educate the general practitioners, who do the bulk of the pediatric practice especially in the rural districts

The gain in the membership has been gratifying. This year as a depression measure the initiation fee has been lowered for a twelve month period to allow every pediatricist to join. The influence of the Academy we hope and believe will in a few years be so great that no qualified man can afford to remain outside of it. It is an altruistic enterprise and like almost everything else worth while in life you will get out of it what you put into it. If the members complain they are not getting anything out of it let them ask themselves what are they doing to remedy this. There is work for all, if they will only do it.

The public should be informed as to who are qualified in pediatrics. The newly formed National Examining Board will take care of that in the future but in the meantime the roster of the Academy members may well serve as a sort of 'Who's Who in Pediatrics' and due publicity should be given this list

The objects of the Academy should be to improve the health and welfare of children, to cooperate with existing agencies, to raise the standards of pediatric practice, and to encourage research.

My own bark has sailed the pediatric waters for forty years, visited many countries, and garnered many strange tales told by the mariners of bygone ages, even if my shipload is not of much value, I have found the voyage replete with interest, and I have enjoyed sharing what I have picked up along the way. And now I may summarize what I have already told you of my impressions of my trip. Pediatric progress is shaped by the character of the age, a suggestion is offered that it might be possible to direct the trends of pediatric thought instead of letting them flow willy-nilly, the infant welfare work suggests possibilities, and in directing the trend we should aim at the birth and survival not of more infants, but of better ones, and that this may perhaps be accomplished by means which others have already suggested and which it would seem could be applied if physical and mental fitness ever again became a popular craze as it once was among the Spartan aristocracy. Other subjects which need attention are the teaching the art as well as the science of pediatrics, the sifting out of the best of our knowledge in some better way than that employed at present, and then of making practical application of what is already known, as well as the very important searching for new knowledge—and not only that but of getting the public to do the same, looking forward to the time, perhaps never to come but at least pleasant to dream about, when preventable diseases really will be prevented, those dependent on heredity controlled at the source, and the heritage of every child will be that of the old Latin ideal of a sound mind in a sound body. And when we consider what modern sanitation and medical science has accomplished in the past fifty years, it may not be as utopian a dream as it sounds at first. May the American Academy of Pediatrics be one of the organizations which will lead the way.

RECURRENT ABDOMINAL PAIN IN CHILDHOOD

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WHEN a child has recurrent attacks of pain which it locates in the abdomen, the problem presented for diagnosis is always difficult. The underlying cause may be unimportant or very important. The pain may be due simply to gas from indigestion, or to some serious pathologic condition which will cause death unless it is recognized and properly treated. Even in children, that is, in those between three and twelve years of age, it is not always certain that the pain is really in the abdomen or, if it is, in what part of the abdomen it is located, the testimony of young children as to these points being notoriously unreliable. The presumption is, of course, that the cause of the pain is located in the gastrointestinal tract. It may be, however, outside of it. In searching for the cause of the pain, it is always wise therefore, to first look for causes outside of this tract. If they can be eliminated then the trouble must be in the gastrointestinal tract.

I have attempted to get some figures as to the relative frequency of persistent or recurrent abdominal pain as the main presenting symptom in childhood and also as to the relative frequency of the various causes of such pain by analyzing some fourteen thousand consecutive cases seen by me in private and consultation practice. As my practice has been almost entirely consultation for the last twenty years, it seems probable that my figures show a larger proportion of such cases than would be likely to be met in a strictly family practice as the more unusual cases are the ones commonly seen in consultation. I know from my own experience moreover, that a larger proportion of cases of recurrent abdominal pain from unusual causes are seen in hospital wards than in either private or consultation practice. In analyzing these cases I have excluded all those in which the pain was present for the first time, whether due to disease of the intestinal tract itself, for example, acute appendicitis or to disease outside this tract for example, pneumonia. Only cases in which the pain had been persistent for a considerable time or in which there had been many recurrent attacks of pain are included. In analyzing these cases it is probably best to take up first some of the causes which on account of their rarity, are least important and those outside of the gastrointestinal tract.

TUBERCULOSIS OF THE SPINE (POTT'S DISEASE)

This condition should always be kept in mind. It will not be missed if the spine is examined and its flexibility tested. Roentgenograms may

be taken for verification, if necessary. In only two instances in this series were the children brought primarily for abdominal pain, the disease of the spine not having been recognized or even suspected. In the rest of the cases of Pott's disease other symptoms had directed attention to the spine.

PELVIC DISEASE

In no case in this series was abdominal pain due to disease of the internal female genital organs, tumors in the pelvis, or disease of the pelvic bones. I have seen instances in hospitals in which these conditions were the causes of the pain. They should always be kept in mind, therefore, and looked for.

LEAD POISONING

Lead poisoning in infancy from eating paint is not very uncommon. At this age abdominal pain is a most unusual symptom. Lead poisoning is much less common in childhood than in infancy. At this age also abdominal pain is not a common symptom. It was only a minor and inconstant symptom in the five cases in this series. Lead poisoning should be thought of, however, in children with recurrent attacks of abdominal pain. A lead line on the gums is almost never found in children of this age. Stippling of the red cells is inconstant. The quickest and easiest method of diagnosis is to take x-ray pictures of the long bones. This is much easier than testing the urine for lead.

URINARY TRACT

Renal Colic—There were only two cases of renal calculi in this series. One of them had pain. Four others had typical attacks of pain which were supposed to be due to stones, but which later were proved not to be. Two others had attacks of severe pain from the passage of sharp crystals. They were shown not to have stones.

Nephritis—Pain is a not uncommon symptom in this condition in childhood. It is seldom, however, the predominating symptom. The diagnosis of "nephritis" is, of course, easy when the urine is examined.

GALLBLADDER AND BILE DUCTS

There was but one case of hepatic colic in this series.

EPIGASTRIC HERNIA

This is always mentioned as one of the causes of persistent or recurrent abdominal pain. An epigastric hernia was found on routine physical examination in seven instances in this series. In no case were there any symptoms from it. Incidentally, I have never seen any symptoms of pain or discomfort from an umbilical hernia in childhood.

INTESTINAL WORMS

With the exception of pinworms intestinal worms are uncommon in and about Boston. There were only four cases of tapeworms and three of roundworms in this series. None of them at any time complained of abdominal pain. There were thirty-seven cases of pinworms. In none of them were there any abdominal symptoms although many of them complained of itching and discomfort about the anus and external genitals.

There are two more causes of persistent or recurrent abdominal pain which are outside of the gastrointestinal tract. These are more common than those which have been discussed. They are abdominal adenitis either retroperitoneal or mesenteric, and tuberculous peritonitis. The diagnosis of abdominal adenitis is often very difficult, that of tuberculous peritonitis usually not as hard.

ABDOMINAL ADENITIS

There were seventeen cases of adenitis in this series. Thirteen were proved to be tuberculous. The other four probably were. There were recurrent attacks of pain in seven or 41 per cent. The adenitis was mistaken for appendicitis in four instances, the true condition being first recognized at operation. On the other hand two cases thought to have adenitis were operated on and found to have chronic appendicitis. These mistakes show the difficulty in diagnosis. They show also that tuberculous adenitis must always be thought of when there is persistent or recurrent pain in the abdomen. In most instances the enlarged glands can be felt if they are looked for carefully. A positive tuberculin test is suggestive. Roentgenograms will often show beginning calcification in the glands.

TUBERCULOUS PERITONITIS

There were sixty-six cases in this series. Fifty of the patients were under three years of age, only sixteen more than three years old. This preponderance of babies is, I think, the rule. Pain was noted in only eight, most of whom were less than three years old. That is, pain is not a prominent symptom of tuberculous peritonitis in childhood. The symptoms at this age are usually indefinite for some time, malaise, anorexia, vomiting, loss of weight. The diagnosis was perfectly plain at the first examination in all but three. It had been missed by the other physicians who had seen these patients simply because they had failed to examine the abdomen carefully.

THE ERYTHEMATOUS GROUP OF SKIN LESIONS

In 1895, Osler¹ published a paper "On the Visceral Complications of Erythema Exudativum Multiforme." In this paper he called at

attention to gastrointestinal crises and hemorrhages from the mucous surfaces in connection with the skin lesions. Abdominal pain was a striking feature in the gastrointestinal crises. He said "the changes in the gastrointestinal canal, at least, are probably the counterpart of those which occur in the skin, namely, exudation of serum, swelling, hemorrhages, and in rare instances necrosis." This paper, as well as another on the same subject in 1904, and the condition which he described were gradually forgotten by most physicians. Trimble,³ however, again called attention to it in 1931 in a paper entitled "The Erythematous Group of Skin Lesions With Especial Reference to Abdominal Pain." He describes purpuric lesions in these cases and says that pain usually precedes the appearance of the purpuric lesions. Pain may occur without purpura. In one case it lasted for three months before the eruption appeared. He says that recurring colic may be for many years the sole feature of this remarkable condition. A pathologic change in the intestinal wall is the cause of the symptoms.

This combination of erythematous or purpuric skin lesions with pain in the abdomen would seem from my series to be quite uncommon. The diagnosis of angioneurotic edema was made in twenty cases and that of erythema multiforme in nine. None of them had any abdominal symptoms. The diagnosis of erythema nodosum was made in eight cases. In one of them, a boy of five, the eruption appeared at the close of the last of repeated attacks of abdominal pain and indigestion. The others had no pain in the abdomen. Patients in eight cases of purpura had hemorrhage from the bowels as well as into the skin. None of them had pain.

GASTROINTESTINAL ALLERGY

Rowe⁴ has been writing a good deal about this during the last few years. He believes that as the result of protein sensitization lesions like urticaria, angioneurotic edema, and dermatitis may occur in the gastric and intestinal mucosa as well as on the surface of the body. He seems to be describing in modern terms what Osler noted nearly forty years ago. He says the chief symptoms are abdominal pain and soreness, diarrhea (16 per cent) or constipation (39 per cent), sometimes vomiting. He believes that these symptoms are due to edema of the mucous membrane and spasm of the smooth muscle, which produce disturbances in peristalsis and function. Abdominal pain and soreness from food allergy may occur anywhere in the abdomen and simulate both acute and chronic conditions. They are most common over the cecum and ascending colon. The x-ray pictures sometimes show a spastic colon or duodenal stasis.

Since having my attention drawn to this condition I have seen one case of this sort. I believe, however, that it is more common than this experience would seem to show but not as important a cause of abdominal

pain in childhood as Rowe would like us to believe. It should always be taken into consideration if the child shows other manifestations of allergy or belongs to an allergic family. Rowe states that skin reactions are comparatively unsatisfactory in the diagnosis of this condition which usually must be made on the history of food dislikes and disagreements and by the use of elimination diets.

INFLAMMATORY LESIONS OF THE GASTROENTERIC TRACT

Peptic Ulcer—This is uncommon in childhood. Foshier,² writing in 1932, could find but nineteen reported cases of gastric ulcer including his own. He found that the symptomatology was the same as in adults and thought that it should be recognized when present. He believes that duodenal ulcer is no more common than gastric. Bloch, Bronstein and Serby³ in a paper of the same year also emphasize the rarity of peptic ulcer in childhood. They say that it 'does not produce the classical symptomatology noted in adults. Continued abdominal distress or cramps several times a day may constitute the sole subjective evidence. The hunger pain of ulcer is rarely noted.'

My experience agrees as to the rarity of peptic ulcer in childhood. This diagnosis was made in but five cases, three of gastric and two of duodenal. In none of them were there any symptoms suggestive of ulcer until hemorrhage occurred. Nevertheless the possibility of peptic ulcer as the cause of persistent or recurrent abdominal pain in childhood must always be kept in mind. In children roentgenograms will probably give more information than analyses of the gastric contents and are much easier and pleasanter for the child.

Recurrent and Chronic Appendicitis—These conditions are the ones most often suspected both by physicians and the laity when children have persistent or recurrent pain in the abdomen. They are however not as often the cause of these symptoms as is usually supposed. Nevertheless, they must always be kept in mind and excluded before any other diagnosis is made. The diagnosis of recurrent appendicitis was made in thirteen of this series. It was proved to be correct by operation in seven. That of chronic appendicitis was made in twenty three cases and proved to be correct in fourteen by operation. In one instance in which the diagnosis of chronic appendicitis was made on the symptomatology and the evidence of roentgenograms operation showed that the trouble was really tuberculous adenitis. In another patient in whom further examination was refused, there was no recurrence of the symptoms. In the rest all of whom were sent for an opinion, and roentgenograms or operation advised, the results are not known. No one knows, of course, how many of these cases I have missed. I do not think many, however, as I have always been on the lookout for them.

The diagnosis must depend very largely on the findings at physical examination during the attacks. Relatively little can be learned from the history. Rectal examination must not be forgotten. There is much difference of opinion as to the value of roentgenograms in the diagnosis of these conditions. I have found them of considerable value and always have them when there is any question as to chronic or recurrent trouble in the region of the appendix. In general, however, it is well to remember that the chances are that the trouble is not in the appendix.

Many surgeons believe that recurrent or cyclic vomiting is a manifestation of chronic or recurrent inflammation of the appendix. My experience does not bear this out. This diagnosis was made in 128 cases of this series. Only three patients died. Only seven had pain in the abdomen. In two cases, the attacks continued after the appendix had been removed to stop the pain before I saw the children. One patient in whom the diagnosis of appendicitis had been made but no operation performed, had only two or three more attacks of vomiting and nothing more to suggest appendicitis. In two cases, roentgenograms showed questionable adhesions about the cecum. One of them had also a redundant colon. The other had ptosis and was cured by a belt. In the others with pain, the attacks were always due to indiscretions in diet in neurotic children.

MALFORMATIONS OF THE INTESTINES

Most of the serious malformations of the intestines will have caused death in infancy. Those which are consistent with life are usually located in or about the duodenum or in the colon. All of them are likely to be associated with constipation as the result of interference with the passage of the intestinal contents. Pain may be caused by increased peristalsis above any constricted area or be due to fermentation in the intestinal contents. Kantor¹ found pain in about 40 per cent of the cases in adults in which the trouble was located in the duodenum, and pain in the right lower quadrant in 13 per cent of those with a low cecum, which he says is the most common anomaly.

Omitting the cases of redundant colon, which should be considered separately, there are but four cases of malformation of the intestines in my series. In one of these moreover, the lesion found at the single x-ray examination was a constriction at the middle of the transverse colon. As this child also had attacks of asthma, it is quite possible that this was simply a temporary allergic manifestation. In only one of these cases was there abdominal pain. There were no cases of persistent Meckel's diverticulum. With this anomaly, moreover, the first symptom is far more likely to be hemorrhage than pain.

The diagnosis of a malformation of the intestine can be made, of course, only with the aid of the x-ray pictures.

REDUNDANT COLON

At birth and throughout infancy the large intestine, especially the sigmoid, is relatively longer in proportion to the small intestine than in later life. This fact must always be kept in mind before drawing the conclusion from x ray evidence alone that the colon is longer than normal. Even in childhood it must be remembered that on account of the narrow pelvis the colon is forced to adjust itself to its surroundings by reduplication and will, in consequence, give a different picture from that in the adult. Nevertheless there is, I think, little doubt that the attainment of the adult relationship is not infrequently delayed and that, in consequence, the colon really is redundant and constitutes an abnormality. In these cases, however, the colon, while long and crowded into folds, is not dilated. Redundant colon is one of the common causes of constipation in early life and the constipation is not infrequently accompanied by pain as the result of exaggerated peristalsis.

This diagnosis, proved by x ray pictures was recorded but three times in my series. I am sure however, that it was present far more often than that, the diagnosis being put down as constipation or indigestion. Pain was noted in two of the three cases with this diagnosis. Kantor however, reports pain in 60 per cent, gas distress in 70 per cent, and tenderness in the right lower quadrant in 24 per cent of his adult cases.

The diagnosis can be made only with the aid of the x ray pictures. Great care must be used however, in interpreting the roentgenograms because of the great variations in the normal.

The treatment is symptomatic. Time will cure most cases in children. A supporting belt often helps. Operation should never be performed.

SPASM OF THE INTESTINES

This is usually spoken of as 'spastic colitis'. This is not a proper term, as the spasm is not always in the colon and in uncomplicated cases there is no inflammation of the bowel. Physical examination except for occasional tenderness is negative. It is usually associated with constipation and quite frequently with pain which is often severe and prolonged. Roentgenograms may or may not show contracted areas of the intestine according to whether spasm is present at the time or not. The pictures will vary from day to day.

The explanation of the symptoms and x ray findings is presumably muscular incoordination which causes spasm of the circular muscular fibers. This spasm may involve only a few fibers or considerable sections of the bowels. It may last for an instant or persist for hours. Hence the variation in the severity of the symptoms. It is said that the spasm may be limited to the anal muscles.

This condition is not a manifestation of spasmodophilia i.e. of a low blood calcium. It is said to occur most often in hypertonic children with

nerve imbalance. This may be true, but it has not been my experience, unless its existence is taken as *prima facie* evidence of hypertonicity. It is intriguing to attribute it to a disturbance of the vegetative nervous system. Perhaps it is, but this explanation does not help us much.

I find this diagnosis but once in my series. I am positive, however, as I look back that I have seen many cases which I failed to recognize, because I have only recently realized the importance of this condition. The diagnosis has to be made largely by a process of elimination. Repeated roentgenograms will help to confirm it. The relief of the symptoms when belladonna and a low residue diet are given proves it.

INJURIES TO THE ABDOMEN

In several of my cases recurrent attacks of pain persisted for some months after a fall or blow on the abdomen. It is safe to assume with such a history that the attacks are the result of some lesion of the intestine, like a hemorrhage into the wall, or adhesions resulting from a localized peritonitis.

PSYCHIC CAUSES

I have seen many cases of recurrent abdominal pain in which I felt that the symptoms were exaggerated because of the emotional make-up of the child or because of undue solicitude on the part of the parents. I have never seen one, however, in which I did not believe that there was a real pathologic basis for the symptoms.

CONSTIPATION AND INDIGESTION

There are over twenty-five hundred cases in this series in which the diagnosis was indigestion and 350 which were diagnosed as constipation. I have not had the courage to go through them all to find how many of them were babies and how many children, or to find what percentage had pain and what did not. I am certain, however, that many of them did and that their pain was relieved when they were properly fed, their life regulated, and their bowels kept open. I am equally positive that the number of these cases was far greater than that of those who had the more serious conditions which have been discussed. I regret that I am not able to prove it, because I realize thoroughly of how little value impressions are.

It is evident, however, from the analysis of these cases that it is not safe to assume that recurrent or persistent abdominal pain is due to improper food, improper methods of eating, overfatigue or lack of proper attention to the bowels, although in the vast majority of cases I am assured that it is. Every case must be studied carefully for causes of pain outside of the gastrointestinal tract. If none of these are found and the symptoms do not yield promptly to regulation of the diet and

life, a gastrointestinal series of x ray photographs should be taken after an opaque meal and others after an opaque enema. The question of allergy should be investigated and the possibility of intestinal spasm kept in mind. In this way only can the cause of the pain be positively determined and due justice given the patient.

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ATYPICAL CHONDRODYSTROPHY

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THE syndrome of chondrodystrophy as described by Parrot¹ in 1876 and called by him "achondroplasia" is by no means as uniform in its manifestations as has been supposed. Pathologically Kaufmann² has distinguished hypoplastic, hyperplastic, and malacic forms. Since his publication, many atypical cases have been described, but opinions differ as to whether these really belong among the chondrodystrophies. Roentgenographically a great variety of forms has been observed which are still unclassified. Among others describing these are Budde,³ Frangenheim,⁴ Grudzinski,⁵ Jarosch,⁶ Krabbe,⁷ Porak,⁸ Silfverskiöld,⁹ and Weil.¹⁰ It appears, therefore, that the classical syndrome of chondrodystrophy (Parrot) represents but one form of the disease, and that only a typical case of chondrodystrophy can be recognized at a glance.

Morquio¹¹ has recently described as an entity under the name of "dystrophie osseuse familiale," a syndrome of dwarfism with roentgenologic changes in the bones. The development of the children in these cases is apparently normal until the end of the first year of life, their symptoms becoming noticeable only after they begin to walk. The trunk, spine and extremities are affected but not the skull and facial bones. Enlargement of the bones is found at the sternum, the spine, and the epiphyses of the elbows, shoulders and knees. In other situations, as at the wrist, ossification is retarded. The ligaments and muscles are flaccid. The joints are hyperextensible, with the exception of those that are inhibited by hypertrophies of the bones. Externally there are shortening and broadening of the thorax and deformity of the spine. The process is not painful, but there are severe functional disturbances. Thus, the knock knee, flatfoot, and muscular weakness cause a typical waddling gait, and the motor power of the hands and feet is diminished. Intelligence and sexual development are normal and correspond to the patient's age.

Roentgenograms reveal severe changes in the process of ossification which Morquio erroneously attributed to the decrease in blood calcium found in his cases. Rarefaction, destruction, retardation of growth, or complete lack of the epiphyses of all bones have been found

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The disease is often familial and hereditary, and consanguinity of the parents has been reported in several instances. Syphilis, alcoholism, and other diseases of the parents do not appear to be causal factors.

Following Morquio's publication, a number of cases were described which resembled each other so closely that all of the authors agreed to classify them as a special entity, Morquio's disease. Undoubtedly the disease had been observed and described before Morquio's time by Nilsson¹ in 1927, and by Weil¹⁰ in 1928 who described cases showing flattening of the vertebrae (platyspondylism), which seem to be long in this category. According to Volentin¹² the two cases of Rabinovitch and Muchin¹⁴ may also be included.

Nilsson¹² described osseous changes in three brothers whose parents and five sisters were well. The brothers were short in stature and had long upper extremities, the fingers reaching as low as the patella. The vertebral bodies of the lumbar and dorsal spine were flattened and the cranial and caudal surfaces of them were uneven. In general however, the osseous structure was normal. Genu valgum was present and in two cases shortened collum femoris. The author discussed the differential diagnosis of rickets, Scheuermann's disease (osteochondritis deformans juvenilis dorsi) and chondrodystrophy.

Lance¹⁵ described two cases of generalized platyspondylism. One of them a child twenty six months old also had bilateral congenital dislocation of the hips and bilateral clubfoot. However the author did not consider this a systemic affection, and since no roentgenograms of the extremities were reproduced there is little evidence that the case belongs in this group.

Two cases of platyspondylism were reported by Weil¹⁰. In one only the changes of the spine were present while the other presented in addition signs of chondrodystrophy.

Mention has already been made of Morquio's description in 1929 of similar deformities in four children in one family.

Valentin¹² reported two cases. He deserves credit for emphasizing platyspondylism as one of the essential symptoms of the disease. He suggested the name "osteochondropathia multiplex."

Deutschländer¹⁶ and Dencks¹⁷ described one case each of platyspondylism in chondrodystrophic children.

Ruggles¹⁸ described Morquio's disease in eight children. In one family of seven children three showed the syndrome, and in another family, two. In the other three children there was no familiar history of osseous disease. In neither family was there consanguinity of the parents. The clinical symptoms resembled those of Morquio's disease but in contrast to Morquio's findings the blood calcium was normal.

Campbell¹⁹ reported the case of a boy, twelve and one-half years old, who showed marked delay of osseous development in some epiphyses, and too early synostosis in others. There were also abnormally flattened vertebral bodies, high intervertebral disks, absence of the epiphysis of the head of the femur, which normally develops at the tenth month, short fibula, and poorly developed cortex of the long bones.

Brailsford's²⁰ case of chondro-osteo-dystrophy doubtless belongs in this group. The boy, aged three years and nine months, was apparently normal up to the thirteenth month of life. He could stand upright, but when he walked, he supported his trunk by putting his hands on his knees. The roentgenograms revealed wide joint spaces, irregular and fragmented epiphyses, especially of the metacarpus and metatarsus, irregular shape and size of the vertebral bodies, and dislocation of the lumbodorsal vertebrae. The long bones were short and thick.

Meyer and Brennemann²¹ described a case, which in its clinical and roentgenologic aspects resembled Morquio's cases to a marked degree. There were, however, no familial occurrence and no consanguinity of the parents. The blood calcium was normal.

Coward and Nemir²² report two cases in Italian brothers whose parents were not related. Blood calcium, phosphorus, and basal metabolism were normal. Platyspondylism, shortening of the fibulae and radii, and fragmentation of the epiphyses were present. One child was born with a crooked left arm.

Barnett²³ described two cases of the same type in sisters, in whom marked generalized epiphyseal disturbance and abnormal cartilage growth were present.

Ellman's²⁴ case of an only child, fifteen years old, whose parents were first cousins, also resembles Morquio's disease.

By external examination the affection (Morquio's disease) can readily be distinguished from the type of chondrodystrophy described by Parrot.¹ The difference is so marked that some authors do not even consider the possibility of chondrodystrophy in the differential diagnosis. The classical type of the chondrodystrophic dwarf is characterized by a relatively large head, a prominent forehead and a flattening of the bridge of the nose, almost normal length of the trunk, short extremities, and well-developed musculature. All of these signs are supposed to be present at birth. On the contrary, children with "dystrophie osseuse familiale" have normal development of the head and face, marked shortening of the trunk in the craniocaudal direction and relatively long extremities. The musculature is flaccid and underdeveloped. Usually no changes are to be seen at birth.

The symptoms of chondrodysplasia, however, are not always so uniform or regular as often stated. The shape of the skull in the classical type is caused by premature trabecular synostosis. H. Müller²⁵ and Hecker²⁶ have described exceptions to this rule. Kaufmann² distinguished two types of cases—one with a deep depression at the root of the nose and the other with a flattening of the entire nose. The picture in Siegert's²⁷ paper on chondrodysplasia (Tab. 4 Figs. 1, 3) does not show the typical shape of the skull and face, and a survey of the illustrations of the numerous atypical forms described in the literature leaves one with the impression that the formation of the face and skull should not be overestimated in diagnosis.

The behavior of the centers of ossification and of the epiphyseal spaces is considered to be essentially different in chondrodysplasia and in osseous dysplasia. According to Ruggles,¹⁸ chondrodysplasia is characterized by the appearance of the ossification centers at the proper time and also by the premature closing of the epiphyseal centers. In contrast in osseous dysplasia the ossification centers are supposed to develop late. However, as early as 1912 Siegert²⁷ stated that in chondrodysplasia some ossification centers in the same hand may appear prematurely and some late, and accordingly concludes that the time of appearance is not significant in this condition.

In marked cases of chondrodysplasia the shortness and thickness of the long bones is typical, but occasionally these symptoms as well as the typical shape of the hand may be partly or entirely absent (Jaroschy,⁹ Silfverskiöld⁸ and others).

Normal length of the trunk, which in the classical syndrome of chondrodysplasia contrasts with the short extremities is due to normal development of the height of the vertebral bodies. In osseous dysplasia the vertebrae are flattened—a fact which was emphasized by Valentin. Although the length of the trunk in chondrodysplasia is frequently normal, the old conception that the spine is unaffected has been found to be incorrect. The pathologic changes have been carefully described by Kaufmann,² Breus and Kolisko²⁸ Sumita,²⁹ and lately by Donath and Vogel³⁰ the last named authors concluding that the adult spine in the chondrodysplastic dwarf is never normal.

Chondrodysplasia originally called fetal rickets in contrast to osseous dysplasia has been described as a fetal disease that is fully developed and recognizable at birth. We had an opportunity of examining a chondrodysplastic dwarf, aged five years whose parents did not notice any abnormality until the end of the first year of life. Krabbe⁷ described an atypical instance in which symptoms developed when the child was six years old. On the other hand, osseous dysplasia does not necessarily develop only after infancy. For example, Ruggles¹⁸ says: 'The condition is congenital and early signs of it

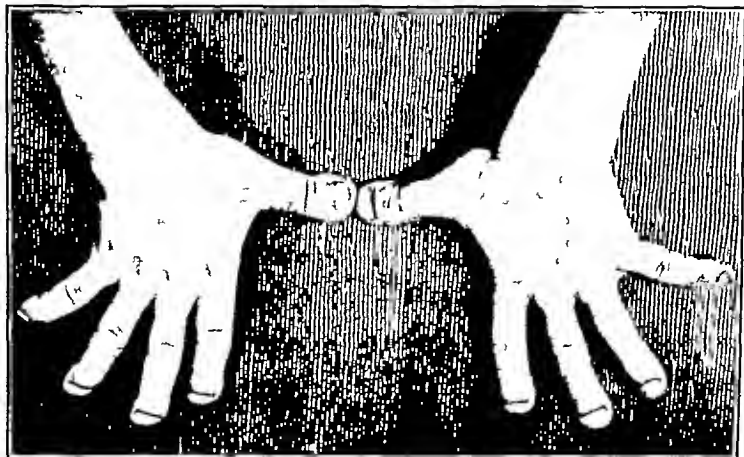


Fig 2—Hands of J O Note the enlargement of the terminal phalanges.



Fig. 3—Spine, showing irregularities on the anterior aspects of the bodies of the fourth and fifth vertebrae.

Apparently this interfered with the elevation of the arms. The arms and legs were normal in length but the epiphyses were enlarged. The upper arms were short in comparison with the forearms. The hands were large and square and the fingers were enlarged especially at the terminal phalanges (Fig 2). There was no limitation of motion except of the arm which could not be lifted above the level of the shoulder. The thighs were normal in shape but extension and abduction were limited. The hips and knees were enlarged. There was a slight genu valgum. The lower legs were normal. The feet were large and there was considerable deformity of the metatarsal bones which gave the foot a short and broad and flat appearance.



Fig 4.—Right upper extremity. Note the irregularities of the epiphyses of the shoulder and elbow joints.

Laboratory findings—Several examinations of the urine revealed nothing abnormal and the blood showed only a mild anemia. The stained smears showed no abnormalities. The serum phosphorus was on one occasion 5.5 mg per cent and on another 5.1 the serum calcium was 12.8 mg per cent and 11.8 on another examination.

Röntgenograms—There were no abnormal findings in the bones of the skull, no abnormal shadows in the brain tissue, and the sella turcica was normal. The bodies of the fourth and fifth vertebrae and a small portion of the sixth showed irregularities on their anterior aspects, which at least indicated slow development.



Fig 5—Right wrist of J O The centers of ossification are irregular and smaller than in a normal child of the same age the epiphyses of the radius and ulna and the proximal ends of the metacarpal bones are also irregular



Fig 6—Hip joint. The acetabulum is irregular the epiphysis of the head of the femur is not demonstrable the outline of the neck is irregular

for a child of twelve years of age (Fig 3) The vertebral bodies were not flattened that is there was no platyspondylia. The well calcified humerus was short and thick the proximal epiphysis was irregular in outline and at the distal epiphysis there was a fragmented appearance of the external and internal condyles (Fig 4) The shaft of the ulna was slender and both epiphyses were irregular in shape (Fig 4) The distal epiphysis of the radius was irregular and thickened (Fig 5) In the carpus there were six ossification centers (Fig 5) These were smaller than normal and irregular in outline The proximal extremities of the carpal bones were



Fig. 7.—Right knee joint. Note the ragged appearance of the distal epiphysis of the femur, the underdevelopment of the proximal epiphysis, and the normal length of the fibula.

irregular and there was irregular reticulation of the bony structure. The phalanges were thicker and shorter than usual (Fig 5) In the pelvis the crest of the ilium and the symphysis pubis were irregular in contour and the acetabulum showed irregularities in calcification and in outline (Fig 6) The epiphysis of the head of the femur was not demonstrable and there was an uneven and irregular appearance of the neck. Both the major and minor trochanters seemed fragmented. The shaft was normal in length and shape. Instead of a regular and smooth line of calcification of the distal femoral epiphysis, there was a ragged and fragmented termination (Fig 6) The proximal epiphysis of the tibia was underdeveloped and fragmented,

and was not overtopped by the fibula (Fig 7) The bone was normal in shape but there were irregularities of the distal end Except for the distal epiphysis, the fibula was normal. Both the calcaneus and the talus showed irregular outlines and structure, the os naviculare was deficiently calcified and represented as an irregular disk The shapes of the cuboid and cuneiform bones were also abnormal The proximal ends of the metatarsal bones were distended, their edges irregular and the calcification defective Except for the distention this was also true of the distal ends There was a peculiar spur like formation at the distal end of the fifth metatarsal bone The bony structure of the phalanges was loose and reticular, and the bones of the first toe were short and thick (Fig 8)



Fig 8—Right foot. Note the disk-like shape of the os naviculare, the club shaped proximal ends of the metatarsal bones and the defect at the distal end of the fifth metatarsal

This case presented certain features of chondrodystrophy, but as others were lacking, it was difficult to decide between this diagnosis and that of osseous dystrophy In reality the case represented an intermediate form between the two diseases It had in common with Morquio's disease normal skull and conformation of the face, lack of micromelia, lack of development of the epiphysis of the head of the femur, genu valgum, normal length of the fibula, waddling gait, and some faulty development of the musculature The apparent late onset of symptoms also speaks for Morquio's syndrome The case resembled Parrot's type of chondrodystrophy in that the neck and trunk were of normal length, there was no platyspondylisis, and the humeri were short and thick

SUMMARY

There is described the case of a boy twelve years old, who presents features which probably warrant placing his condition as intermediate between chondrodystrophy (Parrot) and osseous dystrophy (Morquio). This suggests that the two diseases have a common basis.

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OBSERVATIONS ON THERAPY IN ERYSIPELAS

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IT IS only within recent years that the proper evaluation of therapeutic results in erysipelas has been subjected to a more careful consideration. The appearance of several excellent papers of a highly critical nature has been of inestimable value in the analysis of procedures considered to possess merit in the treatment of this disease. It is apparent that one must be entirely familiar with the natural course of the disease before beneficial results can be attributed to a therapeutic agent. In 1927 Schaffer¹ drew attention to a fact previously emphasized by Ker that the chances of recovery are definitely influenced by the age of the patient. The relationship of mortality to age is summed up by Ker² as follows: "Erysipelas is extremely fatal in the newly born, and the mortality, as will be seen in the table, is high up to the age of five years, and considerable up to ten years. The fewest deaths occur in the decade from ten to twenty years, and thereafter the fatality rate increases steadily with age until a figure of over 25 per cent is reached for patients above the age of seventy." The table of 1,643 consecutive cases is copied from his book.

TABLE I
REPORTED MORTALITY IN ERYSIPELAS*

AGE PERIODS	CASES	DEATHS	DEATHS, PER CENT
0 to 5	78	9	11.5
5 to 10	50	2	4.0
10 to 20	186	3	1.6
20 to 30	272	6	2.2
30 to 40	296	11	3.7
40 to 50	345	16	4.6
50 to 60	235	23	9.7
60 to 70	137	14	10.2
70 +	44	11	25.0
Totals	1 643	95	5.7

*Ker C. B. Infectious Diseases. London: Oxford University Press, 1920.

Since conclusions derived from studies on young adults in whom death so seldom occurs are of little worth, Schaffer and I attempted to compare a series of untreated cases occurring in infants with a group treated with blood transfusions. In cases of patients under one

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year of age reported by various authors as receiving only local treatment, the mortality rate is uniformly over 40 per cent. If many of the cases included in any series are under one month of age the mortality rate is correspondingly higher and often exceeds 75 per cent. If one simply considers the cases in our series under one year of age the mortality rate in the untreated group including forty eight cases was 56 per cent as compared with fourteen cases in the treated group with a mortality rate of only 28 per cent. The report is subject to criticism in that alternate cases were not treated and for that reason a comparison with cases occurring in previous years is less accurate. Second, the small number of cases in the treated group leaves the interpretation open to doubt. As pointed out by Raymond Pearl, only a little consideration is necessary to convince anyone that the trustworthiness or reliability of any conclusion is in a large measure a function of the number of cases on which it is based. It seems likely that our group was simply a sample picked at random, what the biometrists term "random sampling" and that the figures are not truly significant. We did not have sufficient cases to determine whether our results were pure chance or if in all subsequent series approximately the same mortality could be expected. However Schaffer rewrote the chapter on erysipelas in the tenth edition of the Holt and Howland textbook and reported additional cases treated with blood transfusions with a distinctly lower mortality as compared to the untreated group.

Single case reports are of no value, as it has been everyone's experience that even patients with the most severe types of the disease in which extensive areas are involved have occasionally recovered without any treatment having been used. A spontaneous crisis has also been observed on practically every day of the disease beginning with the third, and the temperature will often drop to normal without any previous warning or indication. For this reason, it is nearly impossible to differentiate a spontaneous crisis from an artificially produced crisis. Jacobsen's³ case of an infant twenty two months old, who failed to respond to erysipelas antitoxin during an attack of erysipelas and also during a recurrence but in whom immediate crisis occurred on both occasions following blood transfusions, is of interest, but is always open to the criticism that the same result may have taken place irrespective of the treatment. A similar comment is applicable to Kaiser's⁴ case of postvaccination erysipelas treated favorably with convalescent erysipelas serum. The only definite proof of the efficacy of any therapeutic agent in this disease is the reduction of infant mortality in a large series.

The early enthusiasm associated with the introduction of erysipelas antitoxin seems less in evidence today. Birkhaug's investigations

have been in part repeated by Francis,⁵ who was unable to corroborate his results. Francis has briefly summarized Birkhaug's major observations as follows: "Hemolytic streptococci from erysipelas were found to form an immunologically specific group of streptococci. No cross agglutination with streptococcus scarlatinae was noted. Serum obtained by immunizing rabbits against strains of erysipelas streptococci protected the skin of normal rabbits from infection with the homologous and heterologous erysipelas strains when the serum and bacteria were injected together. The immune serum caused a blanching of the erysipelatous lesion in patients or tended to prevent its spread. This effect was not obtained with scarlatinal antitoxin, nor was blanching of the scarlatinal rash obtained with anti-erysipelas serum. Blanching of the erysipelatous lesion was also obtained with convalescent erysipelas serum. Broth cultures of erysipelas streptococci uniformly gave toxic filtrates which in dilutions of 1 to 1,000 produced a skin reaction in susceptible individuals similar to a positive Dick test. The cutaneous reaction produced by 1 S T D could be completely neutralized by mixing the skin test dose with an equal amount of convalescent erysipelas serum, or with 0.001 c.c. of erysipelas antistreptococcic rabbit or donkey sera. Anti-erysipelas donkey or rabbit serum produced favorable therapeutic results when given early in the disease. The impression obtained was that the serum was antitoxic in nature. A positive or negative skin reaction was considered to indicate incomplete or complete neutralization of circulating toxin, respectively."

Birkhaug pointed out that the results of his studies on erysipelas present a striking parallelism with the observations on scarlet fever reported by Dick and Dick and others. Francis has rightly insisted that clinically this parallelism does not exist for the following reasons: "Scarlet fever is most prevalent between the ages of six months and twenty years, erysipelas is most prevalent under six months and over twenty years. An attack of scarlet fever almost invariably gives lasting immunity, whereas erysipelas often renders individuals more prone to subsequent attacks. In scarlet fever the most prominent clinical phenomena are produced by the absorption of toxin from a local focus of infection, whereas in erysipelas the lesion is associated with actual infection of the skin by streptococci, and dispersed specific lesions comparable to the toxic lesions of scarlet fever are not present." Francis' results differed from Birkhaug's in three respects, namely, the tendency for the cutaneous reactivity of erysipelas patients to become more marked during convalescence, the absence of a demonstrable toxin in the circulating blood of patients in the acute stage of the disease, and the neutralization of erysipelas streptococcus culture filtrates by the serum of most patients in the acute phase of

the disease with apparent loss of the power during convalescence. He concluded "that the pathogenesis of erysipelas is not comparable to the pathogenesis of the specific toxic phase of scarlet fever, and that the mechanism of recovery from erysipelas in adults at least is not a simple neutralization of a circulating toxin through the development of an antitoxin but rather that it is more intimately related to the development of allergy to products of the growth and dissolution of streptococci in the erysipelatous lesion. Furthermore, the failure to find toxin in the blood and the usual presence of a neutralizing antibody in the early acute stage of the disease provide little basis for the view that antitoxin treatment in adults should be of particular value in erysipelas."

Several reports are mentioned by Birkhaug as lending excellent clinical corroboration to his laboratory studies. One was the Bellevue series published by Symmers and Lewis.¹ This report, although forming the basis of the extensive advertising propaganda instituted by the Lederle Company, failed to take cognizance of the variation in mortality in the different age groups. They reported 131 patients irrespective of age with a mortality rate of 5.3 per cent following treatment with antitoxin, as compared to 107 untreated cases with a mortality rate of 11.2 per cent, and concluded that antitoxin was an effective therapeutic agent and that "as far as the immediate attack is concerned, erysipelas is now a vanquished disease." McCann's² criticism of this report is especially praiseworthy. He pointed out that there was no division into age groups, that control and treated cases were observed in different years, that both groups were observed for a period of only forty-nine days in each year and that both groups occurred in months of relatively low mortality of erysipelas, namely May and June. He concluded as follows: "If one examines critically the results reported by Symmers and Lewis, much of their apparently favorable significance disappears." McCann also pointed out that the incidence of a few more or a few less children would have a profound effect on the statistics."

Reports such as the one by Platou, Schlutz, and Collins³ of eighty erysipelas patients from twelve weeks to eighty-four years of age treated with x-ray with a resulting mortality rate of 6 per cent are subject to similar criticism. Incidentally their figures are slightly less favorable than in Ker's untreated group.

In any survey it is essential that one discuss only similar and therefore uncomplicated cases of erysipelas. In addition to the factors previously mentioned, one must consider the presence of a concomitant disease, a possible geographic variation, evidence that the patient is naturally improving at the time therapy was instituted, and particularly the presence or absence of a positive blood culture. The

grave prognosis associated with a secondary blood stream infection has been emphasized by Spiunt.⁹ No one to date has reported a large series of cases in which these factors have been carefully observed.

If one reviews the cases of patients under one year of age treated with erysipelas antitoxin reported by Eley,¹⁰ the mortality is not less than any other series. There were twenty-four cases with eleven deaths, a mortality rate of 45.8 per cent. Eley, however, drew attention to the lower mortality in the group that received antitoxin within seventy-two hours after the onset in contrast to the group treated after the seventy-two-hour period. In the group treated early, the mortality rate was only 21 per cent, whereas in the group treated late in the disease the rate was 80 per cent. These figures are of course very important. McCann's thirteen cases of patients under one year of age included nine deaths, a mortality of 69 per cent. The patients who died were treated on an average of ninety-one hours after the onset, so that this is additional confirmation that antitoxin administered late is without value. In an attempt to corroborate Eley's conclusions, Dr. Bigler and I reviewed all the cases of erysipelas occurring in the Los Angeles County Hospital in patients under one year of age in the five-year period from July, 1928, to July, 1933. There were forty-one cases with a mortality rate of 41.1 per cent. The treatment was varied as a different group of attending physicians are on service every six months. Some received local treatment only, others erysipelas antitoxin, others blood transfusions, and some a combination of all three. There were nearly twice as many cases as in Eley's report, and a total mortality slightly lower than his. Of the twenty-one of our patients receiving antitoxin eleven died, a mortality rate of 52 per cent. In respect to treatment before or after seventy-two hours from the onset of the disease, our figures are at variance with Eley's in that the mortality rate in the group treated early was 60 per cent and in the group treated late 45 per cent. One can only conclude that if erysipelas antitoxin is of value, no definite proof has been presented and one is justified in maintaining an attitude of skepticism. The majority of our cases occurred in the months of January, February, March, and April, and in the five-year period there was no year in which the mortality rate seemed unduly high as compared to another. The report can be criticized in that there was no control series, all the cases were not observed personally, information obtained from records is an inferior method of study, and blood cultures were not performed on all the fatal cases. In infants under one month of age with erysipelas and sepsis, death is practically inevitable. One patient received antitoxin on the second day of the disease, a blood transfusion on the next day, and convalescent blood the following day with no benefit. In many of the cases the spread of the local lesion was not checked after serum treatment. Ker's

opinion, 'a serum can be of little value if marked spread of the local lesion takes place after one or two adequate doses,' is worth repeating. More carefully analyzed reports are necessary before any final conclusions can be made.

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523 WEST SIXTH STREET

MENINGITIS IN THE NEWBORN

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MENINGITIS in the newborn has been considered a rare disease. An increasing amount of literature on the subject with additional case reports would indicate that it is probably more common than we have generally realized. It is not unlikely that many deaths from unknown causes in newborn infants have been due to meningitis since the symptoms are often obscure. There is not much in common between the symptomatology of meningitis at this early age and that which occurs at a later period.

In a general way the etiologic factors in the cases seen in the newborn also differ from those of later life. The meningococcus and tubercle bacillus play minor rôles. Barron¹ reviewed forty-two cases of meningitis in infants, nineteen of which were in the newborn. Of these, seven were caused by the colon bacillus, six by the staphylococcus and streptococcus, two by the pneumococcus, one each by the meningococcus, *Bacillus mucosus capsulatus*, *Bacillus lactis aerogenes*, and *Bacillus pyocyaneus*. Other writers have reported cases caused by the *Micrococcus catarrhalis*, influenza bacillus,² Friedlander's bacillus, Koch-Weeks bacillus, typhoid bacillus,³ and the *Bacillus acidilactici*.⁴ Plischke reviewed the records of 1,305 cases of tuberculous meningitis and found no case in any patient less than two months old. Examination of the literature indicates that special significance must be attached to infection by a group of organisms that ordinarily have very little pathogenicity for older persons. This group comprises the colon bacillus and allied intestinal bacteria.⁵⁻⁸ Attention was directed to such infections in Europe in 1895 by Scherer,¹⁰ who discussed the possible routes of infection. In our own country Hinsdale¹¹ reported a case of coliform meningitis in a three-day-old infant in 1899 and discussed the possible modes of infection. From then until the present time, the literature furnishes enough case reports to indicate that such conditions are not very rare. It is safe to assume that many more cases have not been reported and that numbers of them have gone undiagnosed. It is also apparent that such infections are almost entirely peculiar to early life. Holt¹² in a review of 300 cases of acute meningitis in infants and young children found practically no cases of *Bacillus coli* infection in patients over six months old. He reported three such infections in babies from eight days to six weeks old.

From the time that the first cases were reported, there has been much discussion of the possible avenues of entrance by the organisms into the body. Suspicion was early directed toward contaminated

bath water from which infection might be introduced through skin abrasions, the umbilicus, external auditory canals, and the mucous membranes of the nose and throat. Scherer expressed the opinion that the infection commonly resulted from contaminated bath water, usually involving the middle ear first and secondarily the brain. Hinsdale felt that his patient was infected through the umbilical cord since the mother suffered from a suppurative endometritis. The instruments and fingers of the obstetrician and midwife were suspected of introducing organisms through the mouth and nasal passages. Moll¹² made a careful study of the condition and concluded that coliform meningitis in the newborn was usually secondary to colicystitis. Other investigators have generally rejected this theory. Cases have been reported where the infection appeared to be of antenatal origin. Goldreich¹⁴ reported such a case the infant dying on the second day. He believed the bacteria might have gained entrance into the uterus in the course of a three days' labor during which the amniotic sac ruptured. According to Braid's¹⁵ report of a case of coliform meningitis which developed on the fourth day, smears from the mother's cervix showed the same type of organisms as those recovered from the cerebrospinal fluid of the infant. He believed that the baby swallowed infectious material during birth and that the organisms passed by way of the blood stream from the digestive tract to the central nervous system. This belief that infectious material enters the body through the mouth and digestive tract has been expressed by several writers.^{2 10 17 4} La Fetra¹⁸ however did not feel that infection was very common through aspiration of contaminated liquor amni. Koplik¹⁹ reported a case of coliform meningitis in a male child who was circumcised on the eighth day and three days later developed a colipylitis which was followed by the meningitis one week later. Prematurity and trauma appeared to be predisposing factors in the case observed by White.¹¹

Cooke²⁰ in discussing the possible origin of these meningitis infections advanced certain ideas which offer a satisfactory explanation although he admits that direct proof is difficult. On account of the type of bacteria involved it is assumed that the organisms are derived from the intestinal tract and reach the meninges through the blood. Kohler²¹ expressed similar views and brought out the fact that early blood cultures are frequently positive. Cooke felt that three factors probably play a part. They are (1) the greater permeability of the intestinal mucosa in early infancy (2) low resistance at this early age associated with defective antibody formation, and (3) the influence of digestive disturbances and malnutrition in the forementioned factors. The author would add to these what he considers a very important fourth factor viz, the trauma of the head incident to its delivery through the birth canal resulting in minute tears of the meninges with small hemorrhages. These cause points of least resist-

ance where organisms which are in the circulation may find lodgment and start trouble. The colon group of bacteria can readily be found in the mesenteric lymph nodes and even in the liver of adults. However, they seem to be readily destroyed without the development of any pathologic processes. This is presumably due to the presence of abundant amounts of immune bodies. It has been repeatedly shown that the intestinal tract of the young has a much higher degree of permeability for bacteria as well as unchanged proteins. Coupled with this is the well-known fact that young infants are apt to be low in protective amounts of antibodies against the colon group. Thus, it is felt then that we have a reasonable explanation for the fairly common occurrence of meningitis in the newborn due to infection with the colon group. At the same time we are forced to admit that absolute proof of the correctness of such an explanation is lacking. During birth, or shortly afterward, the intestinal tract of the newborn becomes inhabited by this group of organisms. The immature intestine offers little hindrance to their passage into the circulation. The body of the newborn baby is not plentifully supplied with antibodies against these organisms and prematurity, trauma, malnutrition, starvation, or dehydration may further lessen the quantity. Injuries about the head resulting in tears in the membranes and small hemorrhages offer locations of least resistance where the organisms can lodge and multiply. The result is a purulent meningitis. We believe that this is the *modus operandi* by which the majority of such cases develop.

Meningitis in the newborn presents no very uniform picture. The outstanding symptoms are fever and convulsions. Examination usually reveals some tension of the fontanels, and there may be some separation of the sutures. A stiff neck is not uncommon. Any or all of the ordinary symptoms seen in older persons may or may not be present. The actual diagnosis is made by examining the cerebrospinal fluid. The characteristic thick, brownish pus described by Michael²² seems to be typical of the infections by the colon group. Barron and others have pointed out the fact that the colon bacillus may show marked variations in form, in rate of fermentation, and in motility. Cooke²⁰ called attention to the fact that most of the organisms mentioned in connection with these cases, and designated *Bacillus coli*, have not been described in sufficient detail to determine definitely their identity. It is not unlikely that many of them are members of the group but not identical with *Bacillus coli*. This was true of the case reported here.

The prognosis is uniformly bad. There is no curative treatment. Repeatedly withdrawing the pus gives the infant more comfort and offers the only chance of recovery. Reducing the degree of birth trauma and guarding against exposure, dehydration, and underfeeding should lower the incidence of the disease.

CASE REPORT

V J B., a white female infant, five weeks old, was brought to the hospital because of convulsions, vomiting and a stiff neck.

The family history was unimportant. The mother was a primipara, and the child was born at full term. Delivery was by forceps after a labor of twenty four hours. A large hematoma located just to the right of the anterior fontanel soon suppurated, was opened and drained pus for a short while. The baby nursed at the breast and did well until three weeks of age when she began to have projectile vomiting and general clonic convulsions. The parents stated that the head was drawn back and the pupils dilated. The convulsions continued to occur at short intervals with periods of freedom which lasted one or two days at a time. She nursed well and did not appear to be very ill, but vomited a good deal.

Examination.—The baby was well developed and nourished with some rigidity of the neck and with wide open, bulging fontanels and sutures. There was a scar on the head at the site of the previous suppurating hematoma and another on the occiput which was obviously the result of the application of forceps. The patellar reflexes were exaggerated and there was a positive Kernig's sign. The examination was otherwise negative. The temperature was 101° F. The leucocyte count was 20,000, with 72 per cent polymorphonuclears. A ventricular puncture produced a turbid fluid with a cell count of 216 with 56 per cent polymorphonuclears. Small, very short, almost coccoid gram negative organisms were present in smears and readily grew in cultures.

Course.—The child lived about two and a half months after being seen. Large amounts of pus were drawn off at repeated ventricular punctures. The fluid became more purulent and later was thick and had a peculiar aerid putrid odor. During a great part of this time the condition was good, and there was an actual gain of two and one-half pounds in weight. The head became much enlarged. General convulsions occurred at irregular intervals. She was finally taken from the hospital and died at home at the age of about three months. Since the parents lived in another part of the state, an autopsy could not be obtained.

Diagnosis.—Purulent meningitis due to an unknown organism of the paracolon group, and secondary hydrocephalus.

Bacteriology.—(Miss Ida Lucille Brown University of Oklahoma School of Medicine Laboratory) The organisms mentioned continued to be found abundantly in smears and to grow in pure cultures. Lactose, saccharose, dextrose, mannose, mannite, xylose, raffinose and inulin were all fermented with the productions of acid, but no gas. Endo's medium showed red colonies resembling those of *Bacillus coli*. Eosin methylene blue showed metallic colonies, also resembling those of *B. coli*. Russell's double sugar agar showed initial acidity in the butt of the tube with an alkaline slope turning alkaline throughout in forty-eight hours. There was no gas produced on this medium. The organism was agglutinated by the patient's serum in a dilution of 1 to 300 but not in higher dilutions. Normal pooled serum taken from a group of medical students showed no agglutinating power for the organism. There was no cross agglutination with the colon typhoid group which it most nearly resembled. Guinea pigs were inoculated subcutaneously and intramuscularly with the organism with no results except local redness and swelling. Rabbits were injected intramuscularly, intravenously, and subdurally with no results. Cultures were sent to the Laboratory of the Rockefeller Institute and to the Hygienic Laboratory of the U. S. Public Health Service where the findings were similar to those mentioned before. The organism could not be definitely classified but apparently belonged to the group of saprophytes that are normally present in the intestinal tract.

COMMENT

This case fits in well with what has been said regarding the causative factors. There was a long, difficult labor with considerable trauma to the infant's head. Entrance into the blood stream could have resulted from organisms passing through the intestinal wall or from the suppurating lesion on the scalp. There could easily have been some intracranial injury resulting in one or more points of lowered resistance where the organisms could lodge. The responsible organism was not the colon bacillus, but evidently a member of the colon or some allied group. While a very low degree of virulence was manifested, there was an inability on the part of the child to develop sufficient immunity to overcome the infection.

SUMMARY

Meningitis in the newborn, caused by the colon bacillus and allied intestinal bacteria, while not a common condition, is seen sufficiently often to deserve some attention. These organisms gain access to the digestive tract during or shortly after birth. A highly permeable intestine allows them to pass rather readily into the circulation. A low degree of general immunity offers an insufficient obstacle to their circulation in the blood stream. Intracranial injuries probably result in points of low resistance where the organisms may lodge and cause spreading meningitis.

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THE SCHILLING BLOOD COUNT AS AN AID IN THE DIAGNOSIS OF ACUTE APPENDICITIS IN CHILDREN

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STUDIES of the differential blood smear with special attention to the immature, polymorphonuclear leucocytes, in practically all the known pathologic states have led to the conclusion that in the absence of infection there can be no appreciable increase in the percentage of immature white cells in the blood. Reports on many thousands of cases have confirmed Schilling's original contention that "a real failure" of the differential smear to indicate the presence of infection in the body is unthinkable.¹

Otherwise stated an absolutely normal smear with no increase in the immature neutrophiles enables one to rule out the presence of an acute infectious process in the body with reasonable accuracy. If repeated counts are normal, there is no acute infection present. This premise which is vital to the validity of this work has been amply proved.^{2, 3}

Doubtful cases of 'appendicitis' frequently occur with abdominal pain and localized tenderness with or without vomiting, with normal temperature and normal total leucocyte count, in which it is difficult to make a positive diagnosis. The usual white and differential blood counts vary greatly and are of no real significance. These guides are especially unreliable in children. With improved modern operative technic, rather than risk costly delay and the rupture of an acutely inflamed appendix the surgeon feels it safer and wiser to perform an appendectomy in all doubtful cases at the risk of finding a normal appendix, which, as a matter of fact occurs in about from 30 to 40 per cent of cases operated on for acute appendicitis.^{4, 5}

If it were possible in such uncertain cases to rule out definitely acute infection, some other explanation of suggestive symptoms might be sought, and many unnecessary appendectomies avoided. Operative technic is not uniformly good and the dangers of unskilled surgery at inconvenient times are not negligible. A careful examination of the blood smear by the Schilling method which is not difficult, should unequivocally indicate the absence of an acute inflammatory process in the appendix and thereby minimize unnecessary surgery.

From the A. Jacobi Division for Children of the Lenox Hill Hospital service of Dr. Jerome S. Leopold.

This can be done only, however, when the percentage of immature white cells in the smear is normal (10 per cent or less in children). The presence of from 10 per cent to 15 per cent of these young forms indicates a mild, acute or subacute catarrhal process. More than 15 per cent of the young cells is definite evidence of infection somewhere in the body. Since the blood differential is not specific, it does not determine the nature of the inflammatory process, whose presence, once indicated, must be located by other signs.

REVIEW OF LITERATURE

Efforts to develop a highly practical application of the Schilling count by establishing the absence of an acutely inflamed appendix in the presence of false, though suggestive, signs led to a study of a series of cases as they appeared in the pediatric wards. When this work was begun, there were no reports of a similar nature in the literature. Since then, however, several observers have published the results of their studies on the Schilling index in acute appendicitis, mostly in adults. My observations in children corroborate those which have recently appeared and should be followed by other studies. If these facts can be repeatedly verified, they are of great practical value.

Yaguda⁴ reviewed a series of 671 cases (the ages are not given, but some children must have been included in this number) on which appendectomies had been performed. The blood smears had been examined by the usual method and filed. They were reexamined according to the Schilling classification, and these counts were compared with the histologic findings in each case. These results are of great interest and significance. They are briefly stated as follows:

1 Normal appendices (no evidence of acute inflammation), 277 cases (41 per cent), showed from 2 per cent to 8 per cent stab forms (average 4.3 per cent).

2 Catarrhal appendices (inflammatory process limited to the mucosa) showed 7 per cent to 14 per cent stab cells (average 10.2 per cent).

3 Acute, diffuse, suppurative appendicitis without perforation showed 14 per cent to 28 per cent stabs (average 17.8 per cent).

4 Acute, diffuse, suppurative appendicitis with perforation and peritonitis showed 32 per cent to 47 per cent stabs (average 39.5 per cent).

Yaguda concluded that a normal percentage of immature neutrophils ruled out acute appendicitis.

Herz⁵ found that in 161 cases diagnosed appendicitis it was possible to establish some other diagnosis in sixty-one cases. In thirty-five cases of appendectomy with histologic specimens, eleven were normal.

He concluded that the Schilling count is invaluable and with it one can often avoid operation. An acute case of appendicitis never occurs with a normal blood picture.

In a smaller series, containing ten acute cases and thirty nonacute cases, six of the entire group being children, Goodale and Manning⁶ found that in cases where the appendices showed a general polymorphonuclear infiltration, with or without pus in the lumen, there is a definite left shift. Normal cases showed no increase in the immature white cells. They concluded that the Schilling index renders a more accurate picture of the pathology in the appendix than the ordinary differential count.

Luck⁷ described the blood picture in appendicitis in ten adult cases and noted that the Schilling count is valuable to determine the presence or absence of an infection in the body. He encountered no infection of any severity in the absence of a shift to the left, regardless of the clinical symptoms or the total leucocyte and polymorphonuclear count.

Prochnow⁸ found the use of the Schilling hemogram highly satisfactory diagnostically in acute appendicitis among adults. He noted a marked left shift with increasing severity of the infection.

METHOD AND OBSERVATIONS

On admission a total white cell count and a Schilling differential count were made in every case, prior to operation. Wright's stain was used in preparing the blood smears. If the smears are thin and of even quality, so that there is no clumping or overlapping of erythrocytes the leucocytes will be well formed and easy to distinguish in any portion of the smear. In a properly prepared specimen crushed elements are only occasional. It is impossible to classify cells with any accuracy in thick preparations and failure is often due to this fault.

The white cells were tabulated horizontally in the form of a hemogram as basophiles, eosinophiles, myelocytes, juveniles, stab segments, lymphocytes and monocytes (see Tables I and II). The rarely seen myelocytes, the infrequent juvenile cells and the common de-

TABLE I
NONACUTE CASES

CASE	DATE	AGE IN YEARS	HEMOGRAM							PATHOLOGIC REPORT
			B	E	M	J	ST	S	L MON	
1	10/10/31	8	- 1	-	-	11	55	30	3	Normal appendix.
5	1/ 3/32	8	- 7	-	-	0	7	50	4	Normal appendix.
6	5/28/32	11	- 7	-	-	5	40	44	3	Chronic, thickened mucosa
13	3/ 7/33	10	- 1	-	-	11	70	14	2	Chronic kinked nonacute
18	3/18/33	11	-	-	-	10	62	26	2	Mild, chronic appendicitis.
20	5/ 2/33	11	1	5	-	7	38	45	4	Chronic. Serosa smooth

TABLE II
ACUTE CASES

CASE	DATE	AGE IN YEARS	HEMOGRAM							PATHOLOGIC REPORT
			B	E	M	J	ST	S	L MON	
2	11/ 5/31	11	--	--	--	19	52		25 4	Early acute appendicitis
3	12/10/31	7	- 4	--	--	12	29		51 4	Chronic, catarrhal, retrocecal, non acutely inflamed
4	12/19/31	14	1 --	--	--	26	47		19 7	Acute, exudative, many white blood corpuscles
7	8/ 6/32	12	--	--	--	16	40		40 4	Acute, hemorrhagic, necroses
8	8/ 9/32	7	--	--	--	30	52		15 4	Acute fibrinous exudate at tip
9	12/10/32	5	--	--	--	1	68	26	4 1	Ruptured, peritonitis
10	12/29/32	12	--	--	--	1	21	66	8 4	Acute empyema of appendix.
11	1/10/33	8	- 1	--	--	31	52		5 11	Gangrenous, perforated, free pus, adhesions, peritonitis
12	2/ 8/33	8	--	--	--	40	47		10 3	High retrocecal, acute, covered with fibrin
14	3/10/33	10	--	--	--	20	62		14 4	Acute, inflamed, thickened
15	3/12/33	10	--	--	1	4	51	32	9 3	Acute, suppurative, perforated
17	3/30/33	8	- 1	--	--	2	31	35	24 7	Acute, inflamed appendix
18	4/12/33	5	--	--	--	32	53	11	2 2	Acute, inflamed, ruptured
19	4/13/33	7	--	--	--	2	39	44	8 7	Ruptured, free pus
21	5/17/33	12	- 3	--	--	17	29		49 2	Chronic, catarrhal, serosa injected
22	5/18/33	8	--	--	--	7	34	41	15 3	Ruptured, acute peritonitis
23	5/19/33	9	--	--	--	--	36	34	24 6	Acute suppurative appendicitis
24	7/21/33	13	--	--	--	--	15	77	8 0	Acute congestion, necroses, white blood corpuscles in mucosa section
25	8/10/33	4	--	--	--	35	21		39 5	Retrocecal, appendiceal abscess
26	8/23/33	7	--	--	--	39	50		3 8	Acute, suppurative, necroses
27	8/23/33	12	--	--	--	2	40	28	28 2	Acute, ruptured during removal.
28	8/25/33	12	--	--	--	--	47	35	11 7	Acute, suppurative, necroses
29	8/26/33	8	--	--	--	--	37	49	7 7	Acute, suppurative, necroses
30	9/12/33	9	--	--	--	3	32	52	9 4	Empyema of appendix.

Abbreviations B basophiles E eosinophiles M myelocytes J juveniles ST stabbs S segments L lymphocytes MON monocytes

generated stab or band forms comprise the immature polymorphonuclear leucocytes with nonsegmented nuclei and represent varying degrees of immaturity. An increase in the percentage of this group of cells over normal constitutes a "shift to the left."

In infections of moderate severity the stab forms were increased over normal. As the infection progressed, a further increase in stab forms was followed by the appearance of juvenile cells and, if allowed to continue untreated, resulted in the appearance of occasional myelocytes in the peripheral blood. Though the degree of shift was approximately proportional to the severity of the pathology found, one could not invariably judge the extent of damage in the appendix from the amount of shift. It is important to note, however, that an increase in the immature white cells never failed to indicate the presence of infection.

The segments (the familiar, mature, polymorphonuclear leucocytes with two or more lobes connected by hairlike filaments forming the nucleus) were usually decreased during the acute stage of infection and became more numerous during convalescence. An abnormal increase of the segments with a normal percentage of stabbs usually in-

diated a chronic infection. It is for this reason that a high percentage of polymorphonuclear cells must be examined to determine the number of immature, nonsegmented forms present. One may not assume that a high polymorphonuclear count means a high stab count. Unless acute infection is present, there will be no abnormal increase in stab forms. This important information can only be obtained by grouping the cells according to the presence or absence of filaments in the nuclei.*

REPORT OF CASES

In this series of thirty appendectomies, six cases showed normal histologic specimens. In each of these cases the opinion was ventured that a normal, or at least a nonacutely inflamed appendix would be found and that appendectomy was not urgently indicated. The total white count is omitted in the tables since it played no part in determining the presence or absence of infection. In several instances it was normal in the presence of severe pathology and was therefore regarded as unreliable.

Among the nonacute cases patients 1 and 13 showed stab counts of 11 per cent. This slight increase over normal was not deemed sufficient evidence of acute infection. Case 13 showed 83 per cent polymorphonuclear cells of which 72 per cent were mature segments indicating as the microscopic sections showed a chronically inflamed organ, but no acute infection. Though Case 3, with a high normal figure of 12 per cent stabs was omitted from the nonacute group it was felt that no urgency for operation existed though the appendix might be chronically inflamed and better removed. Histologic section indicated this.

CASE 1.—Patient, aged eight years, gave a history of pain in the right upper quadrant, of twenty-four hours duration, growing worse and appearing in the left lower quadrant. There was no vomiting. There was tenderness in the right lower quadrant. Other examination was negative. The temperature was 99° F. The total leucocyte count was 12,400. The Schilling smear showed 11 per cent stabs, and operation was deemed unnecessary as infection was not shown to be present. Appendectomy was performed and a normal appendix was removed.

CASE 6.—Patient, aged eleven years, was ill for six days with pain in the right abdomen. The patient was nauseous but did not vomit during this period. The bowels were regular. There was no fever. There was slight tenderness and spasm over the right rectus muscle. The total white cell count was 11,000. There were 5 per cent stabs in the smear. With this count there could be no acute or subacute infection in the body and operation was deemed unnecessary. The pathologist reported a thickened mucosa with no necroses and made a diagnosis of chronic appendicitis.

CASE 13.—Patient, aged ten years, complained of pain in the right side for two weeks. There was no vomiting. Examination revealed marked tenderness on moderate pressure in the right lower quadrant especially over McBurney's point. The rectal examination was negative. The temperature was 100° F. The child

was apprehensive and neurotic. With the temperature approximately normal and no other apparent cause for the pain, the stab count was useful in indicating the absence of an acute inflammatory process. The smear showed 11 per cent stabs—a high normal. There were, however, 72 per cent segments as well, suggesting a subacute process. A slightly injected appendix was removed. Section showed two small, superficial ulcerations without inflammatory infiltration—considered subacute. Though this appendix was undoubtedly better out of the body, the count correctly indicated no acute inflammation at the time of operation, and no surgical abdomen.

CASE 20—A girl, aged eleven years, had pain in the right lower abdomen and nausea without vomiting for three days before admission. This pain had recurred at intervals for the past three weeks, but the present attack was the most severe, and the child could hardly sit or stand. The temperature was 99° F. There was definite tenderness on moderate pressure over McBurney's point. Rectal examination verified this tenderness on the right side. The white count was 16,000. There were only 7 per cent stabs, however. A diagnosis of acute appendicitis was made despite the normal differential, though it was argued there could be no acute process with this count. Appendectomy was performed a few hours after admission, and a grossly normal appendix was removed. The pathologist reported a chronic catarrhal appendicitis with a smooth, glistening serosa and a slightly injected mucosa intact.

COMMENT

It can thus be seen from these findings and other reported cases that a count of the immature, nonsegmented, polymorphonuclear leucocytes in the differential blood smear is particularly useful in ruling out acute appendicitis and the need for immediate surgery in cases with false symptoms and signs, where the temperature is normal. In the presence of fever there is usually an increase in the stab forms, and one cannot know whether the appendix or some other part of the body is responsible for the shift. Regardless of the total white cell count or other suspicious signs, a normal percentage of stab cells indicates the absence of acute inflammation in the body and relieves the patient of the need for urgent laparotomy.

It has been shown that in over 30 per cent of the appendectomies performed, normal appendices have been removed for want of an accurate guide as to the actual presence of inflammation. These unnecessary operations can be safely obviated by a more general use of the Schilling index.

In practice, if a case with suggestive signs shows a count of more than 10 per cent stab cells, one should ignore the count and follow the signs. There may be acute appendicitis present. If it shows less than 10 per cent stabs acute appendicitis is hardly possible.

SUMMARY

Thirty cases diagnosed as acute appendicitis and operated on for this condition are described and discussed with special reference to the significance of the percentage of immature, nonsegmented, polymorphonuclear leucocytes in the blood stream.

Of these thirty cases histologic specimens in six were those of normal or nonacutely inflamed appendices, accurately judged by the Schilling count before operation

A table of the whole series with the hemogram and important pathologic findings in each case is given

Though this group of cases is small, similar results have been described in adults. The practical importance of the conclusions arrived at justify further observations on the correctness of these results

CONCLUSIONS

The Schilling differential smear is accurate in determining the absence of acute appendicitis in the presence of falsely suggestive symptoms and signs where the temperature is normal, regardless of the total white count

In so far as this information cannot be obtained with the ordinary examination of the blood smear, the Schilling method is far more valuable and should replace the older count

The routine use of the Schilling index in the future should materially reduce unnecessary appendectomies and the consequent risk incurred

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1070 PARK AVENUE

THE COMPLICATIONS OF RETROPHARYNGEAL ABSCESS

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ONE obtains the impression from textbooks that retropharyngeal abscess is a rather simple condition. No stress is laid upon its complications or on the possibility of serious trouble that may occur in treating this disease. Perhaps because of this attitude little attention has been paid to the reports of isolated cases, or groups of cases, in which death and difficult complications have been described.

When retropharyngeal abscess is kept in mind as a possibility, there is no condition in infancy and childhood easier to diagnose. Yet it is a fact that it is frequently overlooked. It does not always present the classical symptoms of choked-up cry, difficulty in swallowing, retracted head, noisy breathing, and cervical adenitis. The following is a list of the complications which may occur in retropharyngeal abscess. It affords an outline of the difficulties met with in this condition in our own cases and those reported by others.

COMPLICATIONS OF RETROPHARYNGEAL ABSCESS

1 Death —

- a Death unrelated to hemorrhage or rupture of the abscess
 - (1) Spontaneous sudden death
 - (2) Death at or shortly following the time of incision
- b Death due to rupture of the abscess contents into the larynx
- c Death due to hemorrhage

2 Hemorrhage —

- a Primary (before incision)
- b Secondary (after incision)

3 Rupture of the abscess contents into the

- a Throat
- b Larynx
- c Mediastinum
- d External auditory canal
- e Internal auditory canal

4 Other complications —

- a Facial paralysis
- b Esophageal paralysis
- c Pyemia
- d Septicemia
- e Thrombosis of the internal jugular vein
- f Pneumonia
- g Lung abscess
- h Edema of the glottis

CASE 1—Sudden Death Following Incision of a Retropharyngeal Abscess.—

D K., female aged eleven months had bronchopneumonia which was suspected of being tuberculous because of her poor development and positive tuberculin reaction. There was evidence of rickets clinically and roentgenologically. A large retropharyngeal abscess (left) was discovered and incised through the pharynx with the liberation of blood and pus. No anesthesia was used. After incision she suddenly ceased breathing. There was no respiratory difficulty noted. Efforts at resuscitation were without avail. Autopsy showed no cause for sudden death such as laryngeal obstruction or status lymphaticus. The mediastinal lymph nodes were tuberculous. There were isolated tubercles in the spleen liver and kidneys. There was no caries of the spine.

CASE 2—Death Eight Hours After Incision of a Retropharyngeal Abscess.—

A thirteen month-old female entered the hospital with a diagnosis of pneumonia and rickets. A retropharyngeal abscess was discovered three days after admission and was opened by a sharp finger nail with liberation of about a teaspoonful of pus (thick greenish). The child died suddenly about eight hours later while the nurse was washing the mouth with saline. There was no evidence of choking. The respirations stopped suddenly but the heart continued to beat some minutes. Efforts at resuscitation were without avail. No autopsy was obtained.

That sudden death may occur in adults as well as children is attested by the following:

CASE 3—(From the Otolaryngologic Service by permission of Dr. Claude G. Crane, Chief.) D G., female twenty-one years old was seen by the Otolaryngologic Service on the emergency ward with marked swelling of the right side of the neck of four days' duration following a tonsillitis of two weeks' duration. She was one month postpartum. Some dyspnea was present and a retropharyngeal mass was evident. Without anesthesia a blood aspirator was introduced into the abscess through the mouth. Almost immediately the dyspnea became very severe and cyanosis set in. Tracheotomy was done and artificial respiration instituted but to no avail. No autopsy was obtained.

COMMENT

When death follows immediately upon the incision of a retropharyngeal abscess in our cases at least it occurs too quickly and with too little evidence of choking to warrant attributing the cause to suffocation, either by undue pressure in the laryngeal region or by aspiration of the abscess contents. Though our present knowledge is not sufficient to explain the cause of death shock in some way related to vagal or sympathetic stimulation probably plays an important part. In the light of these fatalities what measures can be instituted to reduce the possibility of their occurrence? As long as the exact cause of death is not known one cannot know fully how to prevent them. It would seem wise however that the operation for the incision of retropharyngeal abscess should not be lightly undertaken and done anywhere. The out patient clinic in particular appears to be a poor place to do it. The struggle incident to opening the abscess particularly in chil-

dren should be minimized. Preparation for the incision by administration of a mild sedative might minimize the shock. The use of a mouth gag may be a source of danger.

Bokai¹ describes a case of a four-month-old male infant who immediately after incision "instead of the usual coughing and choking, stopped breathing, became cyanotic and then deathly pale, the heart was scarcely heard, the pulse not palpable. The child was resuscitated by electric stimulation of the phrenic nerve with an induction apparatus."

The same author reports another case in an eleven-month-old girl. "Following a second opening of the abscess in the throat, the respirations ceased, the child lay lifeless. The electric current was successfully used to stimulate respiration, and the child was revived. Pneumonia set in and the child recovered only after a long stormy pneumonic course."

Piatot and Variot² reported the death of an infant with retropharyngeal abscess at the moment of incision. In this case death did not occur from aspiration but from "reflex syncope." They suggest that pressure on important sympathetic and vagus fibers may be a factor.

Chamberlin³ reported a case of sudden death in retropharyngeal abscess on the insertion of a mouth gag before the abscess could be incised. After death, incision revealed a large amount of pus. Holt⁴ reports "We have known unexpected death to occur in two cases shortly after opening the abscess, apparently from shock, which in these patients is sometimes very great. In one case death was due to a secondary retroesophageal abscess."

SUDDEN DEATH DUE TO SPONTANEOUS RUPTURE OF THE ABSCESS

Although some authors, as Koplik,⁵ have felt that there is no urgency about incising a retropharyngeal abscess, and while it is doubtless true that many rupture spontaneously without disastrous results, there are, nevertheless, a sufficient number of sudden deaths from spontaneous rupture reported to warrant the utmost caution.

Bokai¹ reported a case of a female, six months old, whose sudden death was due to rupture of the abscess into the larynx. "The mother, despite the threatened danger, refused incision and insisted on waiting another day. The patient died the following night of asphyxia."

Justi and Gaupp⁶ reported cases of suffocation through spontaneous rupture of the abscess. Charlton⁷ reported sudden death due to asphyxia following spontaneous rupture in a boy, eight years old. The condition followed two weeks after tonsillitis, which had apparently subsided, and the boy was sufficiently able to attend school the day before death.

Brown⁸ reported a case of an infant, six months old, who following a cold had some respiratory embarrassment and difficulty in feeding. On the day of his death the baby had a violent choking spell during which it coughed up a considerable amount of pus and then ceased breathing. Examination after death showed a large abscess cavity in the posterior pharyngeal wall.

DEATH DUE TO HEMORRHAGE

To the danger of asphyxia from spontaneous rupture is to be added the risk of severe hemorrhage by erosion of the carotid vessels. Death due to hemorrhage may occur before or after incision. When hemorrhage occurs it is usually severe. Nineteen of twenty three cases gathered by Lifschutz⁹ from the literature resulted fatally. Of his cases six had spontaneous hemorrhage twelve were secondary to operative procedure, three were traumatic, and two were not described. Wishart¹⁰ reported a case of sudden death from primary hemorrhage in an infant, two weeks old following a sore throat. Cervical adenitis had been present but subsided. Two severe hemorrhages occurred and the child died suddenly. Autopsy showed "the wall of the internal carotid artery was eroded for a distance of about 2 cm. and lay on the posterior wall of the (abscess) cavity."

Lifschutz⁹ reported a case of retropharyngeal abscess in a three year-old boy who was seen on the fifth day of illness and in whom incision was refused. Four days later the child had a profuse primary hemorrhage and died from exsanguination. No autopsy was performed but the abscess cavity was filled with recently clotted blood.

Lidell¹¹ (case of boy fifteen years old), Bokai,¹ Carmichael¹² (case of infant six weeks old) Kaufman,¹³ Wylie and Wingrave¹⁴ Travers,¹⁵ Frank,¹⁶ Kling¹⁷ and others have reported cases of fatal hemorrhage from the carotid artery. In two of Frank's cases death occurred despite efforts at ligation. In Wylie's and Wingrave's cases hemorrhage occurred in a woman aged twenty one years, nine days after operation. Klug's patient a girl aged twelve years suffering in addition from a generalized tuberculosis died from exsanguination ten minutes after the onset of the bleeding which developed on the second day following the incision.

Since death may occur suddenly in a retropharyngeal abscess either from spontaneous rupture or from spontaneous hemorrhage, the question arises as to whether we shall treat the condition as an emergency and incise the mass once it is discovered or treat it as an abscess occurring in any other part of the body. There is no way at present to differentiate the case which may give difficulty although the use of the x ray to determine the extent and location of the swelling may prove helpful.

Many factors, such as the degree of respiratory embarrassment, the difficulty in taking food, the degree of toxicity, the state of nutrition, the stage of the abscess in the throat, must govern the decision. Definite fluctuation should preferably be present, and above all the incision must be carefully done as a major operative procedure. Adequate drainage must be afforded, remembering that pocketing may occur and that the mass may extend into the mediastinum.

LIGATION OF CAROTID TO SAVE LIFE AFTER SEVERE HEMORRHAGE

Ligation of the common carotid and occasionally of the internal jugular vein have been reported as life-saving measures. Travers¹⁵ successfully ligated the internal jugular and common carotid in a case of severe secondary hemorrhage. Pearson¹⁸ ligated the internal jugular vein successfully. Liang²⁰ and his coworkers successfully tied the left common carotid in a woman in whom bleeding occurred on the seventh day following incision of the abscess.

When severe bleeding occurs in the presence of a retropharyngeal swelling either prior to or after incision, there is every indication to treat the case as an emergency. Ligation of the common carotid artery on the affected side should be done at once, for at any moment the hemorrhage may recur, perhaps with fatal outcome. Franklin,¹⁹ however, reported a case of spontaneous recovery of a child, aged seven years, with an abscess eroding the left internal carotid.

THROMBOSIS AND SLOUGHING OF THE INTERNAL JUGULAR VEIN

Mosher²¹ has reported a case of a man who began to run a septic temperature with chills one week after successful drainage of a retropharyngeal abscess. The swelling of the neck increased, and on operation 4 ounces of foul pus were evacuated from the posterior portion of the carotid sheath. The internal jugular vein was found thrombosed, and two inches of the vein were sloughed away. The patient died on the table.

RUPTURE OF THE ABSCESS THROUGH THE EXTERNAL EAR CANAL

Although this mode of termination of the retropharyngeal abscess is not very uncommon, reference to most of the standard textbooks finds no mention of it. Bokai¹ reported a case in a two month old infant he had seen in 1873. "Pressure on the swelling in the throat produced a discharge of pus not only through the original opening but also through the left ear canal."

Two of our cases terminated in a similar rupture through the external ear canal.

CASE 4 —Baby M. C., a girl, eighteen months old, had a draining left ear for four weeks with temperature, for which a left simple mastoidectomy was done. Recovery ensued but one week later the temperature again rose and a left cervical adenitis developed. There was no difficulty in swallowing. After about one week of temperature with little or no symptoms, boggingness of the posterior wall of the pharynx was discovered. While under observation for this condition the cervical adenitis became worse. After a few days during which time no definite fluctuation could be made out in the throat a thick greenish pus began to discharge from the left ear. This was puzzling at first for the ear had been previously negative following the mastoidectomy. Pressure on the outer cervical swelling and on the mass in the throat both produced a welling up of pus into the external canal. The following day the retropharyngeal abscess was incised in the throat with illeration of the same thick greenish pus mixed with blood. Recovery was uneventful and rapid.

CASE 5 —Baby G., female nine months old. At the onset of illness there was mild temperature acute pharyngitis and a slight cervical adenitis. The temperature persisted and was always of low grade. The cervical swelling subsided and became practically negligible. About two weeks after the onset of illness the infant began to refuse all food. The temperature rose to 102° F., and on occasions, higher. Both ears were slightly injected. A small hazelnut-sized swelling was present in the pharynx more toward the right side. Definite fluctuation was present. A throat consultant advised of the fluctuation believed it would be as well to wait overnight. Early the next morning the mother called to say the 'ear had opened' and the child was much improved. Examination revealed a thick greenish purulent discharge from the right ear. Pressure on the pharyngeal mass caused the pus to well from the external canal from a point about halfway from the external meatus. The eardrum was injected but intact. Without further treatment except daily expression of pus through the ear canal by gentle pressure to the throat recovery ensued in a few days.

Lyman²² reported a case of a male adult with rupture through the external canal at the time of operation for a mastoid condition. After the operation improvement was slow until the retropharyngeal abscess was incised in the throat. Pope²³ reported two cases rupturing into the external ear canal. One in a child of eight years and a second in a woman. Both perforations occurred at the junction of the bony and cartilaginous portions of the canal. Bertoin²⁴ reported a case of rupture into the external auditory canal in a girl aged ten years just as the surgeon was exploring the mass in the throat for the point of most fluctuation. Recovery was spontaneous. Doubtless this method of termination of a retropharyngeal abscess is not very rare. It should be kept in mind whenever a very abundant discharge suddenly appears in the external canal, which, when wiped out, promptly fills with pus again. In our cases the purulent discharge differed in character from that seen when the pus came from the middle ear. The pus was thicker and greener than the glaring mucopurulent discharge of a draining middle ear.

MULTILOCLULAR RETROPHARYNGEAL ABSCESS

CASE 6—R R, aged ten months, developed an acute pharyngitis and left otitis media followed by a large cervical swelling on the side of the discharging ear. The temperature fluctuated between 101° F and 103° F for two weeks. Under local treatment the cervical swelling almost entirely subsided, but the temperature continued. Though the child refused food, there was no apparent difficulty in swallowing. The breathing was never labored or noisy though the respirations were somewhat increased. Regurgitation through the nose had occurred shortly after the onset of the illness but only on one occasion, and the mother did not deem this important enough to communicate to the attending physician. The child was treated for pneumonia. Physical examination the third week showed an acutely ill, restless child with increased respirations but no difficult or noisy breathing. The head was not retracted. There was little or no cervical adenitis. Digital examination revealed a slight boggy mass in the pharynx, but no definite mass could be palpated. After from forty eight to seventy two hours, a very definite bulging mass was felt deep in the pharynx, extending below the finger's reach. At this time, breathing had become somewhat labored, and the cry was distinctly hoarse. A throat consultant was called, who incised the abscess without anesthesia or the use of a mouth gag, the head of the patient hanging over the table. At first only about ½ dram of green pus with very little blood was obtained. Not satisfied that the main body of the swelling had been drained, a clamp was inserted quite deep and spread. There was a gush of pus tinged bloody material, and about two or three ounces removed. Bleeding was free for a few minutes causing some concern but stopped spontaneously. There was noted improvement in the child's cry, soon after. Two or three days later the temperature subsided, but throughout the period of convalescence there was an aspiration gagging at the end of drinking. While swallowing proceeded, there was no choking but with the swallowing of the last mouthful gagging always occurred. This did not clear up for one week after incision. Recovery was otherwise uneventful.

COMMENT

This case is instructive in several ways. As a diagnostic problem it gave difficulty because at the time of the development of the retropharyngeal abscess there was a very slight cervical adenitis with an absence of other symptoms usually associated with retropharyngeal abscess, namely, retracted head, noticeable difficulty in swallowing, and noisy respiration. The condition was discovered only in the course of a complete physical examination to ascertain the cause of unexplained temperature. From a therapeutic standpoint, the extension of the abscess into the upper mediastinum might readily have proved fatal if complete evacuation was not given. It suggests a bilocular collection of pus and prompts the feeling that this may be the type of case that goes on to fatal termination despite what is believed to be relief by incision. The operator must feel sure by digital examination afterward that sufficient evacuation has been accomplished.

OTHER COMPLICATIONS

Among the rarer complications of retropharyngeal abscess, Szmurlo²⁶ reported a case of spontaneous rupture of the abscess intracranially.

through the internal auditory canal Lung abscess is reported by Brooks²⁶ quoting a case of Wegner Sepsis with fatal termination is also reported by Brooks Thrombosis of the internal jugular vein is reported by Frank¹⁸ Glogau²⁷ and Waldapfel²⁸ Bokai¹ reported facial paralysis complicating retropharyngeal abscess His patient, a nineteen year-old boy, was unable to swallow for some days following his throat condition and had to be fed by means of a tube

Spingarn³⁰ reported edema of the glottis in a boy, fourteen months old, which terminated in recovery The same author also reported death due to pyemia in a girl, thirteen months old He believes that early diagnosis and drainage might have avoided the complication as the condition was discovered eight days after the onset In a third case he reported bradycardia in an eight year-old boy with a pulse rate of 58 and a temperature of $103\frac{1}{2}^{\circ}$ F Spingarn believed this due to pressure on the vagus

SUMMARY

In puzzling cases of unexplained temperature in infants and children, despite the absence of suggestive symptoms of retropharyngeal abscess, digital examination of the throat should be made To look at the throat is not sufficient Because retropharyngeal abscess often goes undiagnosed and the patient is treated for other conditions, it does not necessarily follow that the mass found on digital examination of the throat has been present for a long period We are all familiar with the rapidity with which a cervical adenitis may show itself Often overnight there may be a marked enlargement of the gland In the same way a retropharyngeal lymphadenitis which has previously manifested itself by a slight boggyiness in the pharynx may flare up in a period of from twenty-four to forty-eight hours to produce a true retropharyngeal swelling For this reason a single, or even two or three consecutive daily examinations of the throat are not sufficient to exclude definitely retropharyngeal abscess The throat must continue to be observed during the febrile period when the cervical adenitis persists and in certain cases even when it has greatly diminished in size or has disappeared As great a source of error as any in our experience has been the failure to consider seriously the presence of retropharyngeal abscess because of a subsiding cervical adenitis Therefore whether a large swelling of the cervical glands is present or not, the presence of temperature not satisfactorily explained in a young child is an indication for digital examination of the throat It is important in such examination that the finger not only be carried down toward the glottis but also upward to the posterior pharynx

Death from retropharyngeal abscess has occurred from rupture of the abscess into the larynx and from hemorrhage from the carotid artery. Sudden death at the time of the incision, or shortly after, has been reported.

Hemorrhage complicating retropharyngeal abscess may be primary, before the incision is made, or secondary, after the incision is done. Primary bleeding usually occurs in cases of longer standing, the time allowing for prolonged action of the burrowing infection in the region of the carotid sheath. If the bleeding is severe and prolonged, it may result in collapse and death. Secondary bleeding is usually late in appearing, coming on several days after the incision at a time when most of the danger is believed past. Several cases of recovery following carotid ligation have been reported. When severe hemorrhage occurs in the presence of retropharyngeal abscess before or after incision, ligation of the common carotid artery on the affected side should be done as an emergency measure. Even should the bleeding stop spontaneously, there is always the danger of recurrence, perhaps with a rapidly fatal outcome from exsanguination.

Though many cases of retropharyngeal abscess rupture spontaneously without disastrous result, a sufficient number of sudden deaths have been reported to warrant great care. It is not necessary, as a rule, to treat retropharyngeal abscess as an emergency and to incise as soon as it is diagnosed. The same rules governing suppuration elsewhere in the body pertain to this condition. Definite fluctuation should preferably be present, and above all the operation should be carried out as a major procedure. Retropharyngeal abscess may rupture spontaneously into the external auditory canal, and this mode of termination is probably not very uncommon.

CONCLUSIONS

1 The complications of retropharyngeal abscess are not as rare as they are ordinarily believed to be.

2 Sudden death unrelated to rupture of or hemorrhage from the abscess has been reported.

3 Death due to hemorrhage, either primary or secondary, may occur. Secondary hemorrhage tends to occur some days after the incision of the abscess.

4 Ligation of the carotid artery has been successfully done in hemorrhage from retropharyngeal abscess. It should be done as an emergency measure whenever bleeding occurs from the abscess.

5 Death due to rupture of retropharyngeal abscess contents into the larynx may occur.

6 The time to incise a retropharyngeal abscess is governed by many factors. Fluctuation should preferably be present, and evacuation

should be complete it should be remembered that multilocular collections of pus may be present

7 A prolonged unexplained temperature is an indication for a digital examination of the throat and this examination should be repeated daily unless the temperature has been otherwise satisfactorily explained

8 The absence of or subsidence of a cervical adenitis does not exclude the presence of a retropharyngeal abscess

9 Rupture of retropharyngeal abscess into the external auditory canal may occur and cases are described

10 Rarer complications of retropharyngeal abscess are discussed

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1156 EASTERN PARKWAY

1532 OCEAN AVENUE

THE EFFECT OF EXTRACT OF PREGNANCY URINE UPON HYPOPITUITARISM IN THE MALE

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IN THE past decade a great interest has been manifested in the field of endocrinology. A more advanced knowledge of the normal physiology of the hypophysis, adrenals, and gonads is making possible a more intelligent understanding and treatment of various endocrine disorders. Since many of the endocrine disturbances arise in infancy or early childhood, a great responsibility falls upon the pediatrician for their early recognition and treatment; thus the early recognition of hypofunction or dysfunction of hypophysis might prevent the unhappy state of dwarfism, sexual infantilism, various menstrual disorders, certain cases of sterility, obesity, etc., in later life.

The epochal works of Evans, Zondek and Aschheim, Allen and Doisy, and others, are largely responsible for the advancement in our knowledge of the function of the hypophysis and the hypophyseal-gonadal relationship.

In 1921 Evans¹ isolated from fresh bovine anterior lobe the growth hormone of the pituitary gland. Extensive experimental work on laboratory animals has since shown its effectiveness.^{2 3 4 5 6 7} Hypophysectomized rats and mice have served as excellent test animals for determining the growth promoting property of Evans' extract, as they have been found to be more sensitive to the growth hormone than normal ones. Complete ablation of the glands results in an abnormal reaction in different animals. Most hypophysectomized animals die of cachexia (cachexia hypophyseopriva) before a normal life span is reached. The most impressive immediate effect is the failure of the animals to grow. In many hypophysectomized rats and puppies, the administration of the growth hormone has maintained normal stature and in some cases resulted in excess of normal. Putnam, Benedict, and Teel⁸ in Cushing's laboratory produced acromegalic changes in a normal English bulldog treated for over one year by injection of anterior lobe pituitary extract. In the human being Cushing,⁹ Engelbach,¹⁰ and others have stimulated growth in pituitary dwarfs by the use of potent anterior lobe extracts.

More phenomenal than the failure of growth, is the failure of genital development in the hypophysectomized child (for pituitary

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tumor) and the retrogressive changes in the genital system of adults. Atrophic changes are observed in the testes, prostate, and seminal vesicles, in the female, similar recessive changes are found in the uterus tubes, and ovaries. Clinically, Simmond's disease¹¹⁻¹² presents the changes. Hypophyseal cachexia in a young child with intact hypophysis has been observed by Goebel.¹³

That the development of the gonads and the secondary sexual characteristics are independent of the growth factor of the anterior lobe of the pituitary is now evident. The sex hormone of the hypophysis was first detected in 1926 when Zondek¹⁴ and Smith¹⁵ in this country independently found that subcutaneous implants of anterior lobe pituitary tissue into immature rats and mice provoked sexual maturity in these animals in from three to five days.

Just as it is possible to extract the growth hormone from the anterior lobe of the pituitary so also is it possible to extract the sex or gonadotropic hormones.^{14, 17, 18} However, a more convenient source of the sex hormone was thought to have been discovered by Aschheim and Zondek¹⁴ in pregnancy urine. Zondek and others discovered that estrin, the follicle ripening hormone secreted by the ovary, is found in large amounts in the body fluids, blood and urine during pregnancy and also in the placenta. It has long been known that the hypophysis hypertrophies during pregnancy. With this physiologic phenomenon in mind, it was hypothesized that there also would be an increased secretion and elimination of anterior pituitary sex hormone during gestation. It was found that the anterior pituitary sex hormone¹⁷ (prolan) appeared in the urine during pregnancy in large amounts and much earlier than the ovarian hormone—as early as twenty-one days after coitus and, therefore, afforded a means of diagnosing pregnancy early.

Because of its greater solubility in organic solvents the ovarian hormone is separated from prolan without difficulty.

At the present time there is a great deal of controversy as to the origin and nature of prolan. Phillip¹⁹ and Collip^{21, 22, 23} believe that prolan originates in the placenta and is not secreted by the anterior lobe of the hypophysis. Evans,²⁴ as a result of recent investigations is of the opinion that prolan originates in the hypophysis. He found that there was prompt appearance of prolan in the blood and urine of males or females after complete surgical ablation of the gonads but to further substantiate his contention, simultaneous hypophysectomy and gonadectomy must be performed. Zondek²⁵ believes that the site of origin of prolan is in the anterior lobe and concludes that it arises in the basophilic cells.

Since the discovery of prolan, a great deal of experimental work has been done to observe its effect upon the genital system of immature male and female hypophysectomized and nonhypophysectomized animals

EFFECT OF PROLAN ON THE GENERATIVE TRACT OF LABORATORY ANIMALS

A great deal of investigative work has been done on the effect of extracts of the anterior lobe of the pituitary and of pregnancy urine upon the genital system of mature and immature animals, for the most part, mice and rats. Chief among the investigators are Smith and Engle, Steinach and Kun, Fels, Brouha, Hinglais and Simonnett, Bourg, Boeters Boist, Doderlein and Gostimirovic, Neumann, Peter, Kraus, Novak, de Jongh, and Moore²⁶. The only uniformity of agreement of investigators as to the effect of anterior lobe extracts and prolan is that neither initiates premature development of spermatozoa and that animals which have been treated do not mate. Engle²⁶ drew the following conclusions from a summary of his own and the work of others accomplished in this field: "1. The testis weight of animals treated with either concentrated urine of pregnancy or with pyridine extract of sheep glands is considerably increased. 2. The increase in the interstitial cell mass after anterior pituitary extract is slightly greater than the untreated control, but after concentrated urine of pregnancy the hypertrophy is very greatly increased. 3. Neither of these degrees of change has been noted following fresh implants. 4. The failure to induce accelerated spermatogenesis is uniform with the findings after implants although tubule size is greater than the control on implanted rats."

Engle²⁷ working with monkeys, corroborated the work in lower animals, namely: increase in size of testes due to tubule growth and an increase in the interstitial cell mass was greater with pregnancy urine than with anterior lobe extract. In no instance (Boeters) was there extensive erosion of the germinal epithelium. The seminal vesicles and the prostate treated with pregnancy urine were much more enlarged than the controls. Working with another series of monkeys, Engle²⁸ found that injections of extracts of pregnancy urine and water-soluble extracts of anterior pituitary produced descent of the testes in ten immature macacus monkeys. The testes became enlarged, the scrotum grew and turgescence became evident. During the course of the injections the scrotum increased in fullness even before the testes had descended into the sac. In a few days scrotal and penile areas became turgescient and attained relatively large proportions the scrotal skin becoming stretched and taut. The scrotal sac was filled with a mucoidlike tissue.

Engle²² states that the scrotal response in monkeys is similar to that obtained in the human newborn, in which the factors are identical—the hormone from the maternal circulation or placenta in its own blood comparable to that injected into experimental animals. He further states that the human is the only organism in which the testes descend at birth, and the human female is also the only one which is known to have the gonad activating principle in the circulation throughout the period of gestation. He concludes, therefore, that this hormone is involved in the natal descent of the testes in the human.

In view of Engle's statement it seems logical to assume that where undescended testes are present in the newborn, excluding faulty development, one factor appears to be important and that is insufficient gonad activating principle secreted by the mother. A worthwhile study, therefore, would be one correlating the relationship of endocrine (pituitary or pituitary gonadal) dyscrasia during pregnancy with undescended testes in the newborn. It is possible also that the underdevelopment of the genital system in hypopituitary states in children may be a result of insufficient pituitary activating principle inherent at birth, the symptoms not becoming manifest until late childhood or adolescence when the secondary sex characters should develop. The frequent history of endocrine disturbance in the mother previous to or during pregnancy supports this contention.

Our work was stimulated largely through the work of Engle with the macaque monkey. We realized that spermatogenesis normally does not usually occur before the age of from fifteen to eighteen years; rarely has it been known to occur before fourteen years. We were primarily interested, therefore, in ascertaining whether extract of pregnancy urine would cause enlargement of the testes, descent of the testes, and growth and turgescence of the scrotum in male children presenting the picture of hypopituitarism. We were also interested in observing the effect of the injections upon the secondary sex characteristics, body growth, obesity, and metabolism.

Since beginning our work in September 1932 we have been further encouraged by the recent report of Smith and Leonard.²³ Using antuitrin-S in hypophysectomized rats they state that spermatids and even sperm may be formed although none were present at the time treatment was instituted. When injections were begun at the time of hypophysectomy regression in the weight of the testes was allowed and enlargement sometimes was found. Atrophy of the tubules was retarded and mature sperm continued to be present for a longer period than in the untreated hypophysectomized litter mates. They concluded that these results suggest that a beneficial effect on spermatogenesis might result from pregnancy urine injection in cases of pituitary insufficiency."

MATERIAL

In this study, eight male children were selected, their ages ranged from five and one-half years to fifteen and one-half years at the onset of treatment. All were diagnosed hypopituitarism by means of their clinical features and laboratory data.

The purpose of this study is to determine the effect of "anterior pituitary sex hormone" of pregnancy urine upon genital development, obesity and weight increase, growth of stature, and upon metabolism.

The treatment consisted of the hypodermic administration of antuitrin-S* three times weekly in the dose of 100 R U for a period of from three to six months. In one instance this therapy was complemented by the oral administration of desiccated anterior lobe pituitary.

Five patients were seen and cared for in the Mandel Clinic of the Michael Reese Hospital, Chicago. Three cases were seen in private practice and were referred to us through the courtesy of Dr. Julius H. Hess. Each of the five patients observed in the clinic received a complete blood count, urinalysis, blood chemistry including NPN, cholesterol and sugar tolerance determination, basal metabolism, and x-ray of the sella turcica. At the termination of treatment, all laboratory work (except x-ray) was repeated. In all cases weights and complete measurements were recorded at frequent intervals and particular notice was made of appearance of the secondary sex characteristics, genital growth, and fat distribution.

RESULTS

Effect Upon Genital Development

CASE 1—A. W., aged thirteen years

History—Obese, undescended right testis, easily fatigued, poor progress in school, birth weight 7½ pounds, early development normal. Sixteen year old sister weighed 169 pounds, mother overweight (165 pounds).

Examination—Pituitary type of obesity, undescended right testis, left testis at internal ring and underdeveloped, penis and scrotum underdeveloped.

Treatment—Antuitrin S, 100 R U, three times weekly for four months and then 200 R U three times weekly for two months.

Results of Treatment—At the end of three months' treatment, right testis was palpated in scrotum, smaller than the left, left testis in scrotum. At the end of six months, both testes and scrotum were larger. No increase in size of penis. Pubic hair began to appear, voice deepened, he was having erections but no emissions.

CASE 2—J. M., aged twelve years

History—Overweight, tired on slight exertion, and did not play with other boys, birth weight 8 pounds, delivery normal, overweight during infancy, early development otherwise normal. Family history negative.

* Antuitrin S was supplied by Parke Davis and Company through the courtesy of H. M. Letton.

Examination—Pituitary type of obesity, marked pectoral and girdle obesity effeminate appearance soft voice, sparse pubic hair testes small, descended penis underdeveloped, length 4 cm occasional erections, no emissions.

Treatment—Antuitrin S 100 R U three times weekly for six months.

Results of Treatment—At the end of six months genitals were enlarged to adult size pubic hair abundant frequent erections, occasional nocturnal emissions voice deeper, increased alertness.

CASE 3—W T., aged ten years.

History—Overweight since infancy Birth weight 12 pounds, instrumental delivery Sister eight years old has been becoming obese in the past six months sister two and one half years old overweight birth weight 10 pounds 7 ounces sister, seven weeks old overweight birth weight 10 pounds mother 222 pounds, stocky, pituitary type father 264 pounds, paternal aunt 200 pounds paternal great uncle 300 pounds.

Examination—Pituitary type of obesity penis small buried in fat testes descended testes and scrotum normal size.

Treatment—Antuitrin S 100 R U, three times weekly for six months.

Results of Treatment—At the end of six months, there was no change in genital development he was having erections occasionally but no emissions.

CASE 4—S. P., aged five and one-half years.

History—Overweight enuresis since infancy birth weight 8 pounds delivery normal rapid increase in weight since measles at three years. Brother twenty years old weighs 200 pounds mother 180 pounds pituitary type father 190 pounds.

Examination—Pituitary type of obesity genitals well developed.

Treatment—Antuitrin S 100 R U., three times weekly for six months.

Results of Treatment—No change in genital development.

CASE 5—L. S. aged nine years.

History—Overweight, becoming more markedly so during past three years, doing poor work in school, lazy and not concentrating well, actions slow fainting spells associated with falling during early childhood none for past four years. Birth weight 7½ pounds; early development slow walked and talked late.

Examination—Obese pituitary distribution of fat, penis and scrotum underdeveloped both testes undescended.

Treatment—Antuitrin S, 100 R. U., three times weekly for six months.

Results of Treatment—At the end of six months both testes were in scrotum but were underdeveloped left one was pigeon-egg size smaller than right scrotum larger no increase in size of penis no erections or emissions.

CASE 6—P C., aged ten and one-half years.

History—Overweight, sluggishness in action of six years' duration, retarded sexual development. Birth weight 7 pounds 15 ounces, early development normal, family history negative.

Examination—Pituitary type of obesity penis underdeveloped testes in scrotum—smaller than normal, sparse pubic hair.

Treatment—Antuitrin S 100 R U three times weekly for five months and then 150 R U three times weekly for one month.

Results of Treatment—At the end of six months treatment, there has been only slight increase in size of the penis testes have become larger pubic hair more abundant and axillary hair had begun to appear. He has become conscious of his genitals, frequently handling them. During the last three months he was having infrequent erections but no emissions.

CASE 7—H M, aged ten years

History—Undescended testes, overweight for past two years, constipated, making poor progress in school Birth weight 9 pounds, early development normal Mother short and stocky, pituitary type, father short and stocky, first child very large baby stillborn.

Examination.—Pituitary type of obesity, both testes undescended, penis and scrotum underdeveloped

Treatment—Antutrin S, 100 R U, three times weekly for three months Patient failed to return for further treatment

Results of Treatment—After four weeks, both testes could be palpated at internal rings, at six weeks both were in the scrotum and were underdeveloped, scrotum, larger After three months the penis had not increased in size, and both testes had remained underdeveloped No pubic hair, no erections or emissions

CASE 8—L R, aged fifteen and one half years

History—Underdeveloped genitals, effeminate, soft voice, rapid increase in weight during past two years Birth weight $7\frac{1}{2}$ pounds, delivery normal, early development normal. Mother obese, pituitary type, younger brother normal

Examination—Pituitary type of obesity, penis small, 2.2 cm relaxed, testes underdeveloped, scrotum moderately relaxed, sparse pubic hair, no axillary hair

Treatment—Antutrin S, 100 R U, three times weekly and desiccated anterior lobe pituitary gland 5 gr tid orally for six months

Results of Treatment—After six weeks penis and testes were larger, scrotum, more relaxed After four months pubic hair was more abundant, axillary hair beginning to appear After six months hair on upper lip was present, heavy growth of pubic hair, axillary hair more abundant, frequent erections. Nocturnal emissions first began ten days after treatment was discontinued Penis larger, 6.7 cm relaxed, testes and scrotum larger, voice masculine Eight months after onset of treatment, nocturnal emissions occurred from two to three times weekly, penis, 7 cm

SUMMARY

Descent of the testes was accomplished in all of the three cases (Cases 1, 5, and 7) of cryptorchism treated In one instance (Case 1), both testes and scrotum showed considerable enlargement at the end of treatment In three cases (Cases 2, 6, and 8) characterized by genital underdevelopment (testes descended), treatment resulted in enlargement of the testes and scrotum, the appearance of pubic hair, the occurrence of erections, and in the two older boys, twelve and fifteen and one half years old (Cases 2 and 8), the occurrence of emissions In two instances (Cases 2 and 8), the penis increased in size In two cases (Cases 3 and 4), characterized by pituitary obesity with normal genitals, treatment resulted in no increase in size of the genitals

Effect Upon Basal Metabolism (Table I)

Five patients received basal metabolism tests at the onset and at the termination of treatment (Table I) In four, the basal metabolic rates were below zero (-3.5, -11.7, -19.4, -8.8), two of which were below the lower limits of normal (-11.7, -19.4), one was +1.0 At the termination of treatment all were minus (-9.7, -11.8, -21.6, -17.0, -11.0), four of which were below the lower limits of normal The case in which the reading was +1.0 at the onset of treatment had dropped

TABLE I
VARIATIONS IN WEIGHT, HEIGHT AND LABORATORY FINDINGS AFTER TREATMENT

NAME	AGE IN YEARS	WEIGHT IN POUNDS		HEIGHT IN INCHES		B M L.		BLOOD CHOLESTEROL (MG PER 100 C.C.)		SLOPE TOLERANCE	
		BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER	BEFORE	AFTER
1 Arnold, W	13	119	119½	53½	50½	-3.3	-0.7	203	105	92-10-40 103-88	92-12-131 108-99
2 Joseph, M.	13	146	144	64	67½	+1.0	-11.8	170	102	80-11-9 123-92	85-92 96-98 73
3 William, T	10	137	149½	50½	78	-11.7	-1.6	208	208	92-11 105-97 0	96-108 103 92-90
4 Sherwin, P	3½	74	81½	46½	49	-19.4	-17.0	192	200	92-120 103 104 123	120-130-144 136-124
5 Louis, S	9	77	77½	50	50½	-8.8	-11.0	208	227	83-11-8 148 11-07	8-120 178 10-04
6 Phillip C.	10½	131½	141½	62½	64	+9.0					
7 Harold, M.	10	81½	78½	58	53½						
8 Lester R.	16½	143	152½	60	68½			103	134		

to -11.8 at the end of treatment. These figures indicate that in four cases (Cases 1, 2, 3 and 5) the prolonged administration of antuitrin-S lowered the basal metabolic rate below the lower limits of normal.

Effect Upon Blood Cholesterol

Blood cholesterol determinations were taken on six of the patients before and after treatment. In four (Cases 1, 3, 4 and 5, Table I), the initial cholesterol determinations were above the upper limits of nor-

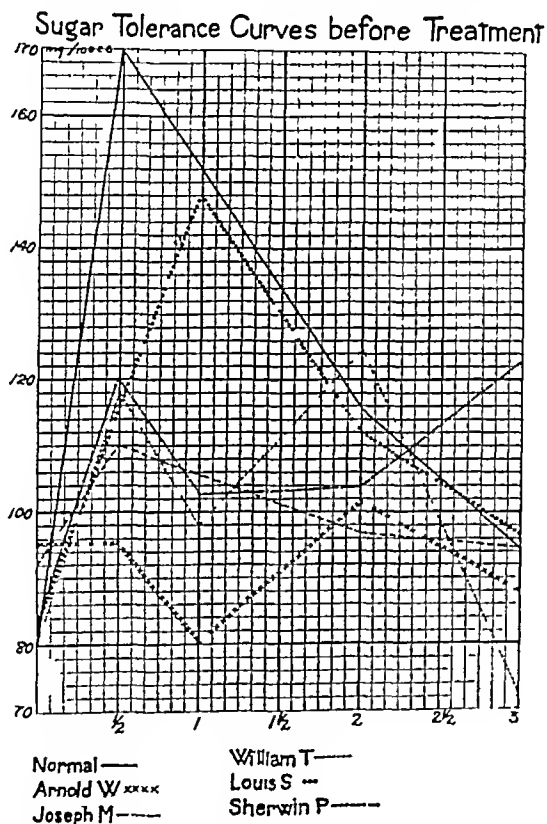


Chart 1

mal.* In two (Cases 2 and 8), the determinations were within normal limits. Following treatment, three showed a slight increase (179—192, 192—250, and 208—225), and two showed a slight decrease (205—195, and 153—135.5). (In the latter, desiccated anterior lobe pituitary had been given by mouth in conjunction with the antuitrin-S hypodermically.) In one case, there was no change between the initial and final determinations. The inconsistency of the change in blood cholesterol level following therapy with antuitrin-S does not permit definite de-

*Normal limits of blood cholesterol from 150 to 190 mg per 100 c.c. of blood.

ductions. We realize, however, that in a larger series of cases more information might be obtained.

Effect Upon Sugar Tolerance

In five cases, sugar tolerance determinations were made at the onset and at the termination of treatment. Chart 1 shows the curves of the individual cases before treatment. In four cases (Cases 1, 2, 3, and 4) the tolerance was increased as shown by the failure of the

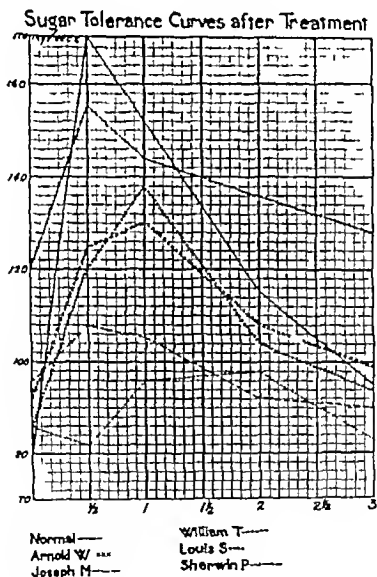


Chart 1.

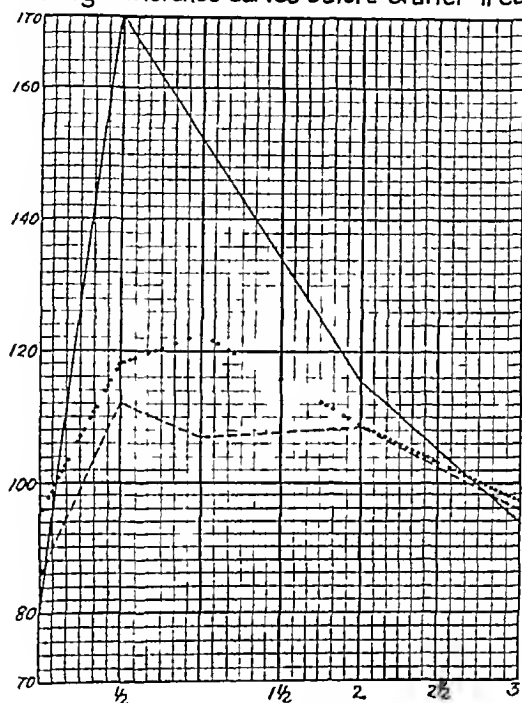
curves to rise above 120 mg per 100 cc of blood in the first half hour and the maintenance of a low level during the three hour period. In no instance was sugar detected in the urine during the three hour period. The mean curve of the five cases is represented in Chart 3 and clearly shows the increased tolerance, the peak of the curve reaching only 113 mg per 100 cc at the end of the one half hour period.

It is interesting to note a definite rise in two (Cases 1 and 4) of the curves following treatment (Chart 2). In three instances there was little change. The mean curve of the five cases (Chart 3) shows

a definite elevation with a maximum peak of 123 mg per 100 cc at the end of one hour. Sugar was not present in the urine in any of the cases during the three-hour period.

It may be concluded that in our five cases there was a tendency for the sugar tolerance to decline under treatment with antutrin-S.

Mean Sugar Tolerance Curves before & after Treatment



Mean Curve (s) before Treatment. ---

Mean Curve (s) after Treatment.

Normal. —

Chart 3

Growth of Stature and Weight Variation

Following antutrin S therapy there was an increase in growth of stature above the normal for age in all but one case (Case 5, Table II). The increase in growth was decidedly marked in Cases 2, 4, 7, and 8, being 2.35, 2.9, 0.63 (treatment for three months), and 1.45 inches respectively, above average increase for the period.

In three cases (Cases 1, 2, and 7) there was a loss of 1, 2, and 3 pounds coincident with an increase in height of 1, 3 $\frac{1}{4}$, and 1 $\frac{1}{8}$ (three month period) inches, respectively. In four cases (Cases 3, 4, 6, and 8) there was an increase in weight of 2, 5.6, 6.6, and 5.3 pounds, respectively, above the normal average for the age. Patient of Case 5

gained $3\frac{1}{4}$ pound, $2\frac{1}{4}$ pounds below the average gain in weight for the six month period

In this small series of eight cases, it may be concluded that antuitrin-S has a stimulating effect upon growth of stature and that it

TABLE II

WEIGHT INCREASE AND GROWTH OF STATURE AFTER TREATMENT

NAME	AGE IN YEARS	DURATION OF TREATMENT	GROWTH IN INCHES	NORMAL INCREASE	WEIGHT CHANGE IN POUNDS	NORMAL INCREASE RELATIVE TO ADF AND HEIGHT
1 Arnold W	17	6 mo	1	0.0	- 3	36
2 Joseph M	12	6 mo	1	0.0	- 2	33
3 William T	10	6 mo.	1 $\frac{1}{2}$	1.0	+ 7 $\frac{1}{2}$	35
4 Sherwin P	7 $\frac{1}{2}$	6 mo	4	1.1	+ 4	21
Louis S.	9	6 mo	1	1.0	+ 4	30
6 Phillip C	10 $\frac{1}{2}$	0 mo	1 $\frac{1}{2}$	1.0	+10 $\frac{1}{2}$	36
Harold M	10	mo	1 $\frac{1}{2}$	0.5	- 3	15
8 Lester R	1 $\frac{1}{2}$	6 mo	2 $\frac{1}{2}$	0.8	+ 0 $\frac{1}{2}$	41

Anterior lobe pituitary orally and antuitrin S

does not stimulate weight loss. It also does not alter the typical pituitary distribution of fat as the pectoral and genital obesity remained prominent in all cases after discontinuing treatment

COMMENT

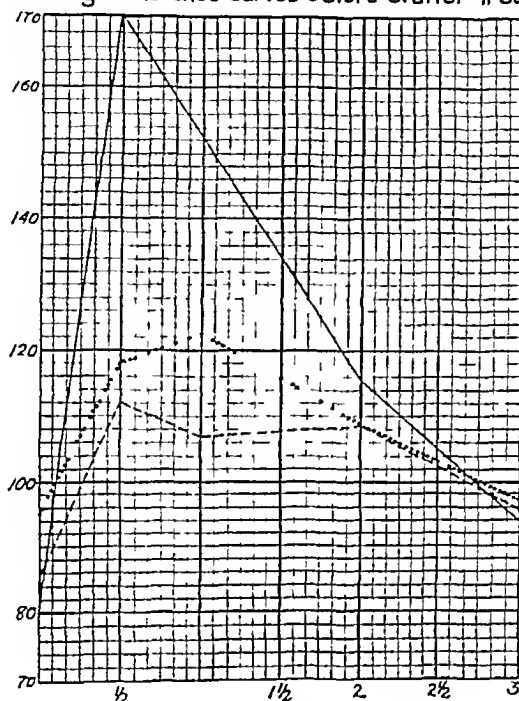
Since initiating our study in September 1932 we have become interested in the reports of Schapiro, Goldman and Stern and Brosins and Schaffer concerning the effect of extract of pregnancy urine upon male genital development

Schapiro²⁰ reported observations on twenty six male patients from nine to twenty nine years of age receiving hypodermically an extract made from pregnancy urine. He states that the preparation contained the active factor related to the anterior pituitary lobe sex hormone in a potency of 100 rat units per cubic centimeter. The diagnosis in a majority of the patients was dystrophia adipogenitalis. An additional four patients studied were two of infantilism aged fourteen and eighteen years and two cases of cryptorchidism, the patients being twelve and sixteen years old. The author divided all cases into four groups: (1) eunuchoid (2) symptom complex—genital hypoplasia, adiposity and decreased bodily function (3) infantilism with retarded general development and (4) cryptorchidism. In estimating the effect of the hormone, Schapiro divided the maturing effect on the genital apparatus into three phases. Grade 1 is related to growth of secondary sex characters or tendency of cryptorchid to downward displacement. Grade 2 includes enlargement of penis and testes with spermatogenesis. Grade 3 is regarded as complete sex maturity. In all cases Grade 1 was obtained by treatment. Fourteen patients were graded 2, and 9 graded

a definite elevation with a maximum peak of 123 mg per 100 cc at the end of one hour. Sugar was not present in the urine in any of the cases during the three-hour period.

It may be concluded that in our five cases there was a tendency for the sugar tolerance to decline under treatment with antuitrin S.

Mean Sugar Tolerance Curves before & after Treatment



Mean Curve(s) before Treatment——
 Mean Curve(s) after Treatment.....
 Normal.——

Chart 3

Growth of Stature and Weight Variation

Following antuitrin-S therapy there was an increase in growth of stature above the normal for age in all but one case (Case 5, Table II). The increase in growth was decidedly marked in Cases 2, 4, 7, and 8, being 2.35, 2.9, 0.63 (treatment for three months), and 1.45 inches respectively, above average increase for the period.

In three cases (Cases 1, 2, and 7) there was a loss of 1, 2, and 3 pounds coincident with an increase in height of 1, 3 1/4, and 1 1/8 (three-month period) inches, respectively. In four cases (Cases 3, 4, 6, and 8) there was an increase in weight of 2, 5.6, 6.6, and 5.3 pounds, respectively, above the normal average for the age. Patient of Case 5

normal. Treatment was discontinued after twelve weeks. Four weeks after withdrawal of treatment aspermia returned.

An analysis of the results of Schapiro, Goldman and Stern, and our series of cases, makes us feel that the administration of extract of pregnancy urine is indicated in hypopituitarism of the male characterized by genital underdevelopment.

Evans, Simpson and Austin² and Collip, Selve, Anderson and Thomson³ working with laboratory animals have recently shown that the combined use of alkaline extract of the anterior lobe of the pituitary and prolan is more effective than either one alone, the former activating or enhancing prolan by its synergistic action.

SUMMARY

1 Eight male children with hypopituitarism were treated with extract of pregnancy urine (antuitrin-S).

2 Descent of the testes was accomplished in all of three cases of cryptorchism.

3 In three cases characterized by genital underdevelopment (testes descended) treatment resulted in enlargement of the testes and scrotum and the appearance of the secondary sex characteristics.

4 In two cases characterized by pituitary atrophy with normal genital development, treatment resulted in no increase in size of the genitals.

5 In four of five cases receiving basal metabolism tests before and at the end of treatment the basal metabolic rates were lowered below the lower limits of normal at the end of treatment.

6 The inconsistency of the change in blood cholesterol level following treatment does not permit definite conclusions.

7 In five cases receiving sugar tolerance determinations before and at the end of treatment the tolerance was lowered at the end of treatment.

8 In seven of the eight cases there was an increase in growth of stature above the normal for the age following treatment.

9 In our series of cases antuitrin S did not stimulate weight loss and did not alter the typical pituitary distribution of fat.

The authors wish to express their indebtedness to Miss Rita Nielsen, R.N., of the Pediatric Clinic for her assistance in this investigation.

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104 SOUTH MICHIGAN AVENUE

ACUTE HEMOLYTIC ANEMIA IN CHILDHOOD

WITH UNUSUAL CARDIAC MANIFESTATION

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DURING the past nine years a number of cases of rapidly developing anemia of sudden onset and severe course have been reported, which cases respond dramatically to a transfusion of whole blood. The salient features of this illness are fever, marked pallor, jaundice, splenic and hepatic enlargement, erythroblastemia, leucocytosis and hemoglobinuria. The most striking features are the suddenness of onset and the rapid and overwhelming blood destruction.

Previous to 1925 when Lederer¹ first called attention to this clinical entity, reference had been made by Osler² and Elsner³ to acute forms of pernicious anemia. The latter mentions also an acute grave form of syphilitic anemia, neither author describes any specific cases. Macintosh and Cleland,⁴ Brill,⁵ Steffens,⁶ Benhamon, Jude and Gill,⁷ have reported cases of acute febrile anemia. Holst⁸ and Christiansen⁹ reported cases which are very similar but both writers indicate that there was no relationship to pernicious anemia. Krumpholtz¹⁰ has reported cases of patients with acute hemolytic anemia who have recovered after single transfusions. Lederer¹¹ in 1928 added three additional cases of acute hemolytic (infectious) anemia. Ottenberg¹² discussed acute febrile hemolytic anemia as an extraordinary specific disease. Lazarus¹³ has reported two cases. Parsons¹⁴ has described four cases, which Lederer pointed out in a subsequent report,¹⁵ as cases of acute hemolytic anemia. Parsons and Hawksley¹⁶ reported five additional cases. O'Donoghue and Witts¹⁷ have collected thirty six cases of patients, eleven of whom were between the ages of two and thirteen years. Some of these cases, however, may not belong in this group. Douglas¹⁷ has added a typical case occurring in adolescence, his report makes no reference to similar instances in the literature.

CASE REPORT—S. A. male, aged eight and one-half years, was born in Palestine and had been a resident of Brooklyn, N. Y., for seven and one-half years. He was admitted to the pediatric service of Dr. M. B. Gordon of the Israel Zion Hospital on February 20, 1933, in the late afternoon.

His complaints were vomiting, headache, diarrhea, fever, and hematuria. The family history was negative. The past history revealed the removal of tonsils and adenoids at two years of age and a mild attack of measles in infancy. Otherwise his health had been excellent. Two weeks before the present illness he had a

From the Pediatric Service of Dr. Murray B. Gordon of the Israel Zion Hospital, Brooklyn, N. Y.

Read before the Brooklyn Pediatric Society, March 2, 1933.

"cold," from which he recovered in three days. He was well until the day before admission when he vomited and complained of headache. His temperature ranged from 101° to 103° F. The urine was bloody, the child's color became yellow and his stools, light colored.

The physical examination revealed a fairly well developed and well nourished male child desperately ill, comatose, markedly anemic, and jaundiced. The temperature was 105° F, pulse varied between 160 and 154, and respirations were very rapid. There was no nuchal rigidity. The eyes reacted normally to light but not to accommodation, the sclerae were deeply jaundiced, and the eyegrounds were negative. The lungs were clear. Percussion revealed that the heart was moderately enlarged both to the right and left. The heart sounds were rapid, regular, and of fair muscular quality at the apical region. Over the aortic area and transmitted downward to the left of the sternum was heard a soft, blowing, high pitched diastolic murmur. There was also heard a moderately long, rough systolic murmur over the apex and midprecordium. The blood pressure was 110/30. The pulse was of fair volume and of a Corrigan type. A pistol shot sound was heard over the antecubital spaces and groins. The abdomen was not rigid or tender, and the liver was just palpable below the costal border. Neither the spleen nor any of the other viscera was palpable. The extremities were normal, and no abnormal neurologic signs were elicited.

The blood examination on admission showed erythrocytes, 3,650,000 per c.mm., hemoglobin, 75 per cent (Sahli), color index, 1.02, leucocytes, 16,500, polymorphonuclear neutrophils, 68 per cent, lymphocytes, 30 per cent, monocytes, 2 per cent.

No urine specimen was obtained the night of admission.

Fluids were administered at once. 10 per cent dextrose solution in normal saline, 1,250 c.c. subcutaneously and 175 c.c. intravenously. A continuous intravenous drip was then attempted but had to be abandoned because of restlessness of the child.

Emesis occurred at intervals, and the child remained in a deep stupor most of the time.

The following morning the child showed no improvement. The jaundice was intense, he was restless at times, stuporous at other times with deep sighing respirations. He appeared to be exsanguinated. The lips were extremely pale and dry. Teeth and gums were stained with bile from the frequent vomiting. There was slight nuchal rigidity, the heart findings were as previously noted, and the examination otherwise was as on the previous day. The temperature was high, 104.5° F, and the pulse ranged about 160. The urine contained hemoglobin but no red cells. The blood count had taken a precipitous drop: erythrocytes, 600,000 per c.mm., hemoglobin, 12 per cent. Because the child's condition was becoming rapidly worse and death was imminent, an immediate transfusion of whole blood, 200 c.c., was ordered, but enough blood was removed for all laboratory data before the transfusion was given. That afternoon another clisis of 500 c.c. of 5 per cent glucose in saline was given. The following day the boy showed marked—startling improvement. He was brighter, and there was absence of the previously noted prostration. The temperature was normal and continued so thereafter. Clyses were continued twice daily. The urine continued to be bloody but not as markedly so. The blood count improved: erythrocytes, 1,000,000 per c.mm., hemoglobin, 15 per cent.

On observing the boy the following morning, the third day in the hospital, all of his symptoms had abated. He was bright, alert, and all vomiting had ceased. The jaundice was still marked, and the mucous membranes were pallid. There was a mass felt in the region of the spleen. Blood pressure was 92/35.

TABLE I
BLOOD PICTURE OF CARP

DATE	HEMOGLOBIN PER CENT (SAFELY)	ERYTHROCYTES PER CMM	LEUCOCYTES PER CMM	NEUTROPHILS PER CENT	LYMPHOCYTES PER CENT	MONOCYTES PER CENT	PLATELETS	BLEEDING TIME	(COAGULATION TIME	STAINED PREPARATION
Feb 20	75	5,600,000	18,500	48	1	25	0	7½ min.	70 sec.	Anisocytosis Polikilocytosis Reticulocytes Marked Microcytosis
Feb 21	12	600,000	14,000	70	1	25	0	7½ min.	70 sec.	Anisocytosis Polikilocytosis Reticulocytes Marked Microcytosis
*Feb. 23	15	1,000,000		70	4	1	16	4 min.	3 min.	Less than above
Feb 24	23	1,150,000	12,900	81	4	1	14			
Feb 27	25	1,100,000	8,000	89	4	4	6			
Feb 27	30	1,500,000	29,000	90	4	0	10			
Feb 28	28	1,250,000	10,400	78	15	0	10			
March 1	36	1,350,000	11,900	70	3	3	1			
March 6	30	2,000,000	8,600	57	1	1	40	3½ min.	2½ min.	Slight Anisocytosis
†March 11	43	2,050,000	9,000	69	1	1	24			
March 15	64	2,400,000								
March 27	60	2,600,000	5,600							

After transfusion.

†After second transfusion.

The heart sounds were normal, but the systolic murmur was heard at the apex, and the aortic diastolic murmur was less intense. The pistol shot sound in the groin persisted and there was slight evidence of the Corrigan pulse.

From then on convalescence was speedy with the exception of a mild attack of vomiting and transitory drowsiness on the fourth day. The heart murmurs persisted for a few days. The pulse pressure narrowed down to normal, and the pistol shot sounds disappeared. The jaundice gradually disappeared, as did the splenic enlargement. His pallor continued despite his feeling of well being, he was given a second transfusion of 200 cc of whole blood on his eighteenth day in the hospital. He was discharged from the hospital as well thirty seven days after admission, March 18, 1933.

LABORATORY DATA

Before Transfusion —

- 1 Blood culture negative
- 2 Fragility of unwashed red blood cells Beginning at 0.325 and complete at 0.250
- 3 Blood chemistry glucose, 145 mg per 100 cc of blood, urea N 67 mg, creatinine, 4 mg
- 4 Icterus index, 80
- 5 Strongly positive indirect van den Bergh test
- 6 Blood smear negative for malarial parasites
- 7 Urine 4 + albumin, 1 + acetone, negative for bile, 4 + benzidine test, granular debris in sediment
- 8 Donath Landsteiner test negative on two occasions
- 9 Blood Wassermann negative on two occasions
- 10 Rosenthal blood test for syphilis negative on two occasions
- 11 Examination of feces negative for parasites and ova
- 12 Urine negative for leucin and tyrosin crystals

After Transfusion —

- 1 Icterus index 48 (March 7, 1933)
- 2 Fragility of red blood cells beginning at 0.350 and complete at 0.250 (March 7, 1933)
- 3 Evidences of hemoglobin were found in the first two specimens of urine following transfusion. Frequent subsequent examinations revealed no abnormal findings except albumin in faint traces
- 4 Kidney concentration test was normal (March 7, 1933)

DISCUSSION

This case presents a picture almost identical to that described by Lederer¹—the sudden onset, high temperature, extreme toxicity, marked anemia, jaundice, hemoglobinuria, and leucocytosis, all of which promptly and rapidly disappeared following a single transfusion. Frequent blood studies failed however, to reveal erythrocytes of the blastic series, except on one occasion when a normoblast was found. Of interest also is the evidence of the high retention values of the metabolites studied before transfusion. Apparently the condition, as Lederer suggests, was one of mechanical retention due to obstruction of the glomerular capillaries of the kidney by the detritus from the enormous erythrocyte destruction. Subsequent studies of both the

urine and blood indicated a return to normal. The fragility test contrary to other observations in this instance resulted in an apparent increase of the resistance. However one of us felt that all the less resistant erythrocytes were destroyed leaving only young resistant cells. Although we felt that the one transfusion checked the disease in order to hasten convalescence the transfusion was repeated once.

The etiology is obscure. Though we attempted through all of our available laboratory facilities to arrive at some explanation we as yet are ignorant of the cause of this illness.

Of particular interest a finding that has not been reported in association with this condition specifically, is the aortic diastolic murmur with its concomitant signs. In many of the case reports mention is made of systolic murmurs hemie in origin.

Goldstein and Boas¹ explain this phenomenon as due to a dilatation of the heart because of the deficient oxygen supply to the cardiac muscle and a subsequent stretching and relaxation of the aortic ring. Cabot and Locke¹⁸ and Ortner¹⁹ observed diastolic murmurs in severe secondary anemia and offered this same explanation. Sahli²¹ many years ago suggested the alteration in the blood as the cause. Morse²² more recently noted diastolic murmurs with Corrigan pulse and pistol shot sounds in the arteries of the groins in infants with marked anemias and observed their disappearance as the condition of the child improved. Our patient gradually became free of his murmurs as his anemia improved and all the concomitant signs of aortic insufficiency, increased pulse pressure, Corrigan pulse and pistol shot sounds in the groins gradually and permanently disappeared.

SUBSEQUENT FOLLOW UP EXAMINATION

On January 8 1934 approximately ten months after his discharge from the hospital the boy appeared to be apparently normal except for a mild secondary anemia.

Blood study Erythrocytes, 3 000 000
 Leucocytes 6,000
 Hemoglobin 70 per cent (Sahli)
 Polymorphonuclear neutrophils, 44 per cent;
 Monocytes 1 per cent
 Lymphocytes, 50 per cent
 Eosinophiles, 4 per cent
 Basophiles, 1 per cent
 Coagulation time seven minutes
 Bleeding time four and one-half minutes,
 Fragility of red blood cells beginning at 0.42 and complete at 0.275

Blood Chemistry: (in mg per 100 c.c. of blood)

Glucose, 122.7 mg
 Urea, N 18.1 mg
 Creatinine 1.72 mg
 Uric acid, 3.22 mg

of any of the secondary male sex characteristics of puberty, but there was an increasing tendency to obesity. His past history other than given was negative. He had a sister who died at another hospital from a brain tumor.

Physical findings on admission showed a well developed and nourished white male child in deep coma. He had a definite girdle of obesity, the breasts were prominent and large. The genital organs were underdeveloped for his age, and he had the long tapering fingers characteristic of hypopituitarism. His left pupil was larger than the right. There was a bilateral horizontal nystagmus and a questionable choking of the discs. His nose, ears, and mouth were negative. The heart and lungs presented no abnormalities. His blood pressure was 70/30. There was some spasticity of his extremities with deformity due to contracture. His genitals were of the infantile type. He had both a positive Oppenheim reflex and Babinski reflex and exaggerated knee and ankle jerks on both sides. Spinal puncture was made, and the fluid was obtained under increased pressure, but otherwise it was negative.

X-ray pictures of the skull showed that the cranium was slightly enlarged, and there was evidence of markings which would indicate an increase of intracranial pressure. The sella turcica was not clearly outlined, but was enlarged and showed evidence of erosion of the anterior process. These findings pointed to definite evidence of brain tumor, apparently in the region of the pituitary body or sella turcica. The neurologists who examined the patient stated that the adiposity together with the infantile genitals was suggestive of a pituitary tumor and that the increasing irregularity of gait and difficulty in walking suggested a cerebellar tumor. Ophthalmoscopic examinations revealed congested discs, which supported the probability of a tumor in the region of the sella turcica. At the time of admission the temperature was 104° F, and pulse, 110. Respirations were frequently of the Cheyne Stokes type. His condition grew rapidly worse. Twenty-five per cent magnesium sulphate intramuscularly and spinal puncture failed to affect his intracranial pressure. His respirations grew more labored, his temperature higher and pulse imperceptible. He died the day after admission at 12:40 P.M. His temperature by that time had reached 109.5° F rectally. The clinical diagnosis was left cerebellar tumor and a Frohlich's syndrome due to a pituitary tumor.

Autopsy revealed the marked adiposity and feminine type of build and the small size of the genitals. There was a marked girdle of obesity. Peripancreatic fat and fat surrounding the urinary bladder in abundance was noted. The mesenteric lymph nodes were slightly enlarged and the mesentery was very thick, the result of its fat content. The rest of the body did not show anything remarkable until the head was opened. The following was the pathologist's report of his examination of the brain.

On stripping back the scalp, the head was found to be unusually large, showing rather marked bulging in both parietal regions. The scalp and external surface of the calvarium were otherwise normal. When the calvarium was removed, it was found to be extremely thin and to show some erosion of the bone in the parietal regions. In the parietal and temporal regions the bone was shaped to fit the convolutions of the brain. The cerebral hemispheres were large and bulging. The convolutions were flattened with a corresponding obliteration of the sulci. The pia arachnoid was transparent. The fluid beneath it was not increased. When the frontal lobes of the brain were elevated, a large cyst containing approximately two ounces of clear fluid, as well as some material resembling butter, was found at the base of the brain. The anterior wall of this cyst seemed to be formed by the pia arachnoid at the base of the brain and included the optic chiasm, which had been greatly stretched and showed almost

complete separation of the two sides. When the posterior lobes of the brain were raised in removal the tentorium was found to be adherent to the posterior surface of the brain. When it was removed, there was adherent to it a large mass of sebaceous material containing hair. When the brain was removed and placed upon the table, it was so soft that the septum pellucidum split longitudinally revealing a cyst filled with sebaceous material and hair which occupied in addition to the midportion of the brain parts of the thalamus and extended down into the interpeduncular fossa at the base of the brain. The ventricles were greatly distended with clear fluid thinning the cortex over the ventricles to 5 mm. The ventricles were filled with clear cerebrospinal fluid and had smooth walls. Sections into the cerebellum showed no pathologic change. The pituitary body had been pushed down against the base of the sella turcica by pressure of the cyst and was rather small and flat. Inspection of the orbital plates of the base of the skull showed them to be eroded. The remainder of the skull was normal.

SUMMARY

1. A case report is presented of a child who had both the symptoms of a brain tumor and of hypopituitarism. At autopsy a dermoid cyst of the midbrain was discovered which cyst besides causing marked increased intracranial pressure and internal hydrocephalus, produced a pressure atrophy of the pituitary body.

2. The case is reported because of its rarity and also because of the interesting symptoms of a Brülch's syndrome explained by the autopsy findings.

3. Recent literature is reviewed, and the conclusion is drawn that these dermoid cysts are inclusion tumors due either to ectodermal rests or trauma in which skin or hair is carried inside the body.

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STATUS THYMICOLYMPHATICUS

(WITH REFERENCE TO ASPHYXIA AS THE CAUSE OF THE ORGANIC FINDINGS
AND THE PHENOMENON OF SUDDEN DEATH OCCURRING IN THIS CONDITION)

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A CRITICAL review of the literature indicates that there is no accepted hypothesis which adequately accounts for status thymicolymphaticus and the sudden death which occurs in conjunction with this condition

One fact that is well established regarding thymicolymphatic overgrowth is the importance of the thyroid gland. In 1924 D Marine¹⁰ discovered by experimental removal of the suprarenal cortex, that the presence of the thyroid gland is necessary in order to produce thymicolymphatic hyperplasia. Thyroid feeding leads to thymus hyperplasia, as has been shown by Hoskins² (1910), Utterstrom (1910), Courier³ (1921), and Khvanskaja-Kroll⁵ (1929). Due to lack of data, the significance of thyroid stimulation was not clarified. Sperdel⁴ in 1926 described signs of red blood cell production in the venous sinuses of the frog's thymus upon thyroid feeding, this he explained by a greater need for oxygen due to the increased basal metabolism. The originator of the erythropoietic hypothesis of the thymus, Hewson,¹ in 1777, explained the persistence of the thymus until puberty by a greater need for oxygen during the period of development. Cannon⁷ found that mechanical asphyxia stimulates the thyroid. Crile¹² recognized asphyxia as one of the causes which may stimulate the thyroid in Graves' disease. But the hypothesis has never been suggested that an asphyxial cause antecedent to the rise of basal metabolism must be the cause of status thymicolymphaticus, that the different causative factors which are known to stimulate the thyroid merge into one principle that of primary asphyxia, furthermore that the rôle of the thyroid in status thymicolymphaticus is compensatory for the asphyxia and the continued increase of basal metabolism is the result of overcompensation.

By asphyxia is meant any insufficiency of tissue respiration. The several causes of asphyxia in thymicolymphatic states are listed in Table I, which gives a complete series of the thymicolymphatic states. Among the varied causes of asphyxia are mechanical asphyxia (laryngospasm, compression of the trachea), decrease of the oxygen carrying medium (hemolysis, hemorrhage), stimulation of

metabolism by emotion physical exertion toxic stimulation of the heat center stimulation of katabolic processes due to lack of an anabolic hormone (suprarenal cortical insufficiency)

TABLE I

THE OCCURRENCES OF THYMICOLYMPHATIC HYPERTROPHIES AND THEIR SUPPOSED ASPHYXIAL CAUSES

OCCURRENCE OF HYPERTROPHIA	THE CAUSE OF ASPHYXIA
1. Experimental status thymicolymphaticus produced by removal of suprarenal cortex (and the gonads) (Marino)	Removal of an anabolic hormone resulting in stimulation of katabolic processes.
2. Thymicolymphatic constitution (Paltauf) Familial group (Donaldson)	Chromaffin hypoplasia. In other cases congenital allergy (See also groups 1 and 2.)
3. Thyroid feeding (Hoskins, Utterstrom Corrier, Kivianskaja Kroll)	Toxic overstimulation of metabolism (This cause does not cover the cause of asphyxia in Graves' disease)
4. Graves' disease	The following conditions merge into one principle that of asphyxia: emotion pain hemorrhage infection foreign protein physical exertion anesthesia adrenalina injection, suprarenal-cortical insufficiency
5. Acromegaly (Hammar Marino)	Asphyxia is inferred from a stage of thyroid stimulation.
6. Myxedema (Hammar Marino)	Similar to previous group
" Addison's disease (Marino)	A stage of suprarenal cortical insufficiency is supposed
8. Epilepsy (Lenox, Cobb, Vollaud, Hammar)	Physical exertion, possible mechanical asphyxia.
9. Spasmophilia (Hammar)	Similar to previous group
10. Febrile diseases (Hammar)	Probable toxic stimulation of heat center
11. Allergy foreign protein (MacDonald Waldbott)	The katabolism of foreign substances increases the demand for oxygen
12. Thymicolymphatic hyperplasia in soldiers (Gebele)	Continued emotional stimulation excessive physical exertion.
13. Snake venom poisoning (Hammar)	Hemolysis, respiratory paresis.

The considerations upon which the above hypothesis is based, can be summed up as follows. In all cases of status lymphaticus there has been uncovered some form of asphyxia as the only condition which can account for the thyroid stimulation in the hyperplasias. Moreover all causative factors which play a part in eliciting thyroid crises and Graves disease appear to be asphyxial in nature. This aspect of thyroid stimulation, its being secondary to asphyxia, suggests that thyroid stimulation in status lymphaticus is compensatory

for asphyxia. Compensatory hyperfunction of the organs concerned is dependent upon the rise of their metabolism which is regulated by the thyroid gland. The increase of circulation and respiration, the increase of oxygen intake, etc., in their turn indicate that the compensatory mechanism for asphyxia is hyperfunctioning. Unduly increased metabolism can be considered as overcompensation.

No hypothesis of status lymphaticus is adequate without an explanation of sudden death. Increased liberation of adrenalin, which also can be the consequence of asphyxia (Cannon), adequately explains sudden death. Such hyperadrenalism has been found in conjunction with sudden death and is further indicated by the hyperpyrexia of the body and by the presence of pulmonary edema. It is accepted, that ventricular fibrillation is among the mechanisms of sudden death, and that epinephrine plays a great part in the experimental production of this phenomenon.

A considerable amount of evidence can be adduced to support the above statements.

W. B. Cannon's⁹ discovery, that asphyxia plays a causative rôle in stimulating the thyroid gland, is of great importance.

There is evidence to show how great a part physiologic asphyxia plays in the pathogenesis of Graves' disease, a syndrome showing status thymicolymphaticus in at least 60 per cent of the cases. Crile¹² states that thyroid crises in Graves' disease and Graves' syndrome itself may be due to (1) emotional excitement, (2) pain, (3) hemorrhage, (4) asphyxia, (5) infection, (6) foreign protein, (7) physical exertion, (8) anesthesia, (9) adrenalin injection.

One observes that each of these phenomena is related to a state of asphyxia. Emotional excitement and pain which are characterized by reflexes of flight or defense, decrease of the oxygen-carrying medium by hemorrhage, physiologic stimulation of metabolism by physical exertion, and toxic stimulation of metabolism are all characterized by an increased demand for oxygen. The asphyxial nature of the above conditions is corroborated by the increased liberation of adrenalin which has been described in most of them: increased secretion of adrenalin in mechanical asphyxia, pain and emotion (Cannon), in fever (Cannon), in anesthesia (Goldzieher¹⁰), in foreign protein invasion (Houssay and Molinelly¹¹).

The investigation of Schmorl and Ingiers¹³ corroborates still further how frequently the production of adrenalin is increased in diseases characterized by asphyxia. They examined 517 pairs of adrenal glands for adrenalin content from cases of diversified pathologic conditions.

The average adrenalin content of the suprarenals of healthy individuals is 4.50 milligrams. In Schmorl's series there were two cases of

sudden death showing status thymicolymphaticus. One had 8.75 mg and the other 6.50 mg of adrenalin in the suprarenals.

The average adrenalin content for cases of valvular heart disease was much higher than normal. This group showed an average of 6.54 milligrams of adrenalin. Sixty one per cent of this group had higher values than the already high group average. Sixty to seventy per cent of the cases of lobar pneumonia and cases of adhesive pericarditis had higher values than the normal average. The adrenalin values in fever have never been found decreased. In no other type of disease was the adrenalin content found increased except in that characterized by asphyxia.

Besides Schmorl's communication we have been unable to find any data regarding the adrenalin content of the suprarenals in status thymicolymphaticus. There is valuable indirect evidence of increased adrenalin output in sudden death. We refer again to the hyperpyrexia of the body (Vaschoff²³). Waldbott²⁴ published the pathologic findings in over 30 cases of sudden death. In this series of cases pulmonary edema was a very frequent occurrence. It is a striking fact that adrenalin in sufficiently large doses causes pulmonary edema in the experimental animal (Auer and Gates²⁵).

The evidence tends to indicate that there is increased adrenalin production in those cases of status thymicolymphaticus which have a sudden death. We believe that the significance of the increased adrenalin output within physiologic limits is compensatory and it is the result of physiologic asphyxia (Cannon).

Increased heat production if it is continued indefinitely as is the case in experimental status lymphaticus and in Graves' disease can be interpreted as the result of overcompensation of the thyroid and adrenals. This may occur through hypersensitization of the metabolic centers. Thus a secondary asphyxia will arise with further effort at compensation by the thyroid and adrenals. A vicious circle will originate and continue until the organs of tissue respiration are exhausted or successful therapy interrupts it. The signs of sensitization in Graves' disease are numerous such as a lowered threshold to x ray erythema, hypersensitivity to adrenalin and iodides, dermographia, in fact activation of every organ (Crile).

The phenomenon of sensitization of the cell by adrenalin was demonstrated by Cannon in the physiology of the muscle. The same author states that adrenalin sensitizes every tissue.

Consistent with the asphyxia hypothesis of thymicolymphatic hyperplasias are the following syndromes which in their turn substantiate the formulation of our major concept.

1 *Experimental thymicolymphatic hyperplasia*. Marine¹⁶ and his coworkers in 1924 produced experimental status thymicolymphaticus

10 *Status thymicolymphaticus in soldiers* Gebele⁷ states that from 50 to 85 per cent of young soldiers had status thymicolymphaticus during the World War. It is possible that continual emotional stimulation will explain this occurrence. We frequently observe the increase of basal metabolism in our clinical tests upon excitement of the patient. Experimentally the thyroid is stimulated by emotion (Cannon).

11 *Thymicolymphatic constitution of Paltauf* Although the asphyxial states underlying thymicolymphatic overgrowth can be acquired in later life, there is a constitutional form described by A. Paltauf¹⁴ in 1889. We enumerated the acquired forms at the onset for a didactic reason. The asphyxial cause or its equivalent, the thyroid stimulation, can be more easily pointed out in the groups of acquired status thymicolymphaticus. Paltauf's discovery of status thymicolymphaticus was the result of observation of minute facts which seemed to recur. Paltauf described the lymphatic habitus: fair amount of fat, pallor, scanty body hair. The constitutional anomaly could result in the failure of the nervous centers of the heart, centers situated in the brain. This was a remarkable intuition, which materialized forty years later by the discovery of fibrillation reflex centers in the brain. Clear distinction should be made between Paltauf's theory of constitutional defectiveness of nervous units in the brain, and other theories which tried to explain sudden death by overstimulation of the vagi by hormones or toxins originating from the thymus.

Wiesel¹⁵ in 1904 made a further contribution to the essential discovery of Paltauf. Wiesel described his observation that hypoplasia of the chromaffin system especially of the suprarenals is associated with thymicolymphatic states. Resulting from this decrease of chromaffin tissue Wiesel assumed a decrease of adrenalin secretion and advocated the supremacy of the vagi in status thymicolymphaticus. Wiesel's monograph on the thymus gland appeared in 1911. In this work sudden death was interpreted as the consequence of thymogenous vagotomy.

We shall recall that chromaffin hypoplasia is a competent cause of asphyxia leading to status lymphaticus although the constitutional (congenital) type of status lymphaticus may not always be due to chromaffin hypoplasia. Von Surr, quoted by Gebele⁵ and Zondek,¹⁷ could not confirm the coexistence of chromaffin hypoplasia with status lymphaticus in all of their cases. Status lymphaticus of the constitutional type may also be the result of congenital allergy (Waldboott¹⁸) or of hypoplasia of the gonads (Zondek¹⁹).

Marine states that status thymicolymphaticus may be congenital and acquired. A study of Table I convinces us that this is true. The constitutional nature of status thymicolymphaticus was studied by

Donaldson³¹ who showed by roentgenograms of a large number of children, that thymus hyperplasia appears to occur to family groups

The doctrine of vagotony is criticized by Cannon¹⁰ who considers it absurd to have hormone control for qualitative parasympathetic functions, which would result in simultaneous actions of an undesired nature. Cannon holds that organ control is largely achieved by innervation while adrenalin has a quantitative influence upon both the sympathetic and craniosacral autonomic systems.

Among others Hartman³² demonstrated the great influence of adrenalin upon the craniosacral autonomic vasodilators. Hess³³ described dilatation of isolated capillaries by adrenalin.

Such clinicians as von Bergman³⁴ and Goldstein³⁵ found the classification of patients into a sympathetotome and a vagotomic group impracticable.

The knowledge of status lymphaticus was widened by the discovery of Marine that thyroid stimulation is indispensable in the pathogenesis of status thymico lymphaticus.

The series of thymico lymphatic hyperplasias is thus completed.

The validity of the asphyxia hypothesis of status thymico lymphaticus must receive its final test by its application to the accepted mechanism and pathologic findings of sudden death and we believe this requirement can be admirably satisfied.

The tangible pathology in status thymico lymphaticus consists of overgrowth of the thymus gland and lymphatic tissue, pulmonary edema, dilatation of the pulmonary capillaries, petechiae on the serous surfaces and compression atrophy of the trachea in some cases. Compression of the trachea *in vivo* was observed in 300 cases of thymic overgrowth in children. Compression of the trachea in adults does not seem to play an important part. Obstruction is also possible through pressure paralysis of the inferior laryngeal nerves which results in variably in death (Ch. Jackson Pancoast³⁶). The rise of the apex of a hyperplastic thymus and bulging in the jugular notch was described by Rehn³⁷ in 1906. Intermittent compression is bound to add to the existing degree of asphyxia which in its turn may cause further hyperplasia. A vicious circle develops which may result in sudden death by a critical rise of asphyxia, hypoadrenalism and ventricular fibrillation.

Ventricular fibrillation as a mechanism of sudden death is accepted by Aschoff³⁸. Paltauf came to the conclusion that failure of the nervous centers of the heart in the brain causes death in these cases. Pott³⁹ and his assistants witnessed 8 sudden deaths of children. Pott describes the attack: "The child becomes deeply cyanosed, the glottis is closed, the extremities are in rigid extension, the head is thrown back

the spine in opisthotonus." When this deeply livid child is seen, the drama is ended; however, the heart stopped at the onset of the attack.

In Pott's autopsy records pulmonary edema was not mentioned.

From these three observations it appears that the extent of pulmonary edema is very often not sufficient to cause death, but that a mechanism which leaves no pathologic evidence, namely, ventricular fibrillation, is more than likely the cause. Increased liberation of adrenalin which was found to be the consequence of asphyxial states, may have a paramount importance in the causation of ventricular fibrillation and would explain the pulmonary edema, when this is present.

The experimental data on ventricular fibrillation and on innervation of the heart point to the sympathetic system and increased adrenalin liberation as the agency by which this mechanism of death can originate.

Anatomic investigations show that the preponderance of the sympathetic fibers to the heart end in the left ventricle.

Rothberger and Winterberg⁶⁶ found that upon stimulation of the left accelerans, or left ganglion stellatum, ventricular fibrillation ensued in 30 per cent of the experiments. They were able to demonstrate that in the presence of a minute amount of barium or calcium, an infinitesimal amount of adrenalin (0.00001 gr.) caused ventricular fibrillation.

Brown and Samet⁶⁹ further developed this chapter of physiology, showing the influence of the central nervous system upon ventricular fibrillation. This is consistent with the occurrence of sudden death upon central nervous impulses. The discovery of a fibrillation reflex center in the brain by Brown and Samet⁶⁹ recalls the contention of Paltauf that the overtaxation of the nervous centers governing the heart was the cause of death in these cases.

* * *

The physiology of the thymus was reviewed by Marine¹⁸ in 1932, who came to the conclusion that the thymus, originating close to the parathyroid, may have something to do with calcium metabolism. Solis' and Riddle's²² experimental investigations on the relation of the thymus to calcium metabolism are quoted by Marine.

In 1919 Park and McClure⁴¹ completed an experimental and critical review of the thymus problem by extirpation of the organ in a large number of dogs. They reached the conclusion that the thymus was without influence upon the bony development and rickets.

The results of irradiation of the thymus are in harmony with the results of extirpation (Hess, G H,⁴⁰ Barnes⁴²) Unfavorable reports upon thymus irradiation by Bireher⁴¹ came from goiter regions and should be critically considered

The relation of the thymus to the thyroid was studied by means of intraperitoneal transplantations and led to the erroneous claim of Capelle and Bayer,⁴³ and Bireher⁴⁴ that the thymus played a part in the pathogenesis of Graves disease The labyrinth of errors is well illustrated by the work of those who claimed to have found thyroid hyperplasia on extirpation of the thymus (Klose Vogt,⁴ Matti,⁴⁵ MacLennan⁴⁶) This conflict is thoroughly discussed by Park and McClure who state that the thyroid preeminently exhibits marked unaccountable variations from the normal type and also responds with well marked structural alterations to a variety of environmental influences, some of which appear to be exceedingly mild⁴

Hunger being one of the causes resulting in an atrophic thyroid, we feel that the well known hunger involution of the thymus may find its cause in the hunger atrophy of the thyroid

The theory of nucleic synthesis in the thymus occupied an important place in the literature and is connected with the names of Dustin⁴⁷ and Liesegang⁴⁸ This theory is based on the ectodermal origin of the small thymus cell The histogenesis of the small thymus cell was reviewed by Ruth Deaneley⁴⁹ in 1929 This author pointed out the chemical and staining peculiarities of the small thymus cell and claimed that both thymus medulla and cortex are of ectodermal origin Hammar,⁴⁷ Maximow⁴⁶ and Popoff⁵⁰ represent the mesodermal theory of origin of the thymus lymphocyte The mesodermal theory of the small thymic cell and its erythropoietic function is championed by Speidel,⁴ and negated by Marine⁵¹

The problematical rôle of the thymus as a growth promoting organ was experimentally reviewed by Uhlenhuth⁴⁴ in 1919 The investigation led to the conclusion that the thymus does not promote growth Hammar⁴⁷ also does not believe that such a function of the thymus is proved although it is not excluded by this authority

Hammar the most prominent investigator of thymus pathology and physiology advanced the hypothesis of detoxification by the thymus, the thymus having an immunologic function In recent years thymolymphatic hyperplasias have been reported in a number of conditions which have no connection with immunity

We feel that the thymus is a regressive organ, the function of which is obliterated Thymus hyperplasia is always preceded by asphyxia, and it is dependent on thyroid stimulation These two facts may indicate that the thymus has been an organ of tissue respiration

SUMMARY

A review of the literature indicates that asphyxia in status thymicolympathicus is not symptomatic, but causative. The hypothesis is advanced that the rôle of the thyroid in status thymicolympathicus is compensatory to a primary asphyxial cause. The different causative factors which are known to stimulate the thyroid all merge into one principle, that of primary asphyxia, which is antecedent to the rise of basal metabolism. This statement, that the stimulation of the thyroid is compensatory for asphyxia, can be made because some form of asphyxia was uncovered in all thymicolympathic states as the only common characteristic which can account for the thyroid stimulation, essential for all these conditions and because thyroid stimulation is always secondary to asphyxia. Continued increase of basal metabolism is considered as the result of overcompensation.

The generalization that asphyxia is the only cause of thyroid stimulation, is contrasted with the opinion that has been expressed that asphyxia is one of the causes of thyroid stimulation in thyroid crises and Graves' disease. This generalization became possible through the recognition that increase of adrenalin liberation was reported in all conditions which are stated to produce thyroid crises and Graves' disease. Increased liberation of adrenalin was taken as an indicator of a state of asphyxia. In Schmorl's statistics, extending to 517 cases of varied pathologic conditions, increased production of adrenalin was found only in those characterized by asphyxia. Increased liberation of adrenalin and asphyxia appear to denote the same thing in medicine. Cannon's discovery, that asphyxia stimulates the adrenalin output, appears to have a universal significance.

The asphyxia hypothesis was applied to all clinical syndromes of status thymicolympathicus, and to the experimental production of thymicolympathic overgrowth by removal of the suprarenal cortex, which appears to be one of the numerous ways by which asphyxia can originate.

The validity of the asphyxia hypothesis was further tested by its application to the sudden death problem. This basic requirement could also be satisfied. The pathologic findings in sudden death in status lymphaticus are seldom sufficient to explain death. A mechanism of death which does not leave sufficient trace, namely ventricular fibrillation is considered the cause by Aschoff. This mechanism is consistent with the increased liberation of adrenalin in asphyxial states. Increased adrenalin content of the suprarenals was found in two cases of sudden death by Schmorl. We can infer the increased adrenalin effect in sudden death further from the hyperpyrexia of the body described by Aschoff and from the more or less marked pulmonary edema.

Thus we have an all including hypothesis of status thymico-lymphaticus, which has no exceptions and offers a satisfactory explanation as to the role of the thyroid gland in these conditions. It also explains satisfactorily the original problem of sudden death. The search for a solution for this enigmatic phenomenon led Paltanf to the discovery of status lymphaticus.

TABLE II

THE CAUSATIVE ROLE OF ASPHYXIA AND THE SIGNIFICANCE OF THYROID STIMULATION IN THYMUS PHYSIOLOGY IN THE PATHOGENESIS OF STATUS THYMICO-LYMPHATICUS AND GRAVES' DISEASE AS FOUND IN THE LITERATURE

AUTHOR	CAUSE OF ASPHYXIA	ROLE OF THE THYROID
Hewson ¹	Growth of the organism (More oxygen is needed more red cells are produced by the thymus)	-----
Speldel ²	Increased basal metabolism (More oxygen is needed more red cells are produced by the thymus.)	Causation of asphyxia
Crile ³	Asphyxia is one of the causes of thyroid crises and Graves disease	Causation of hyperkintetism
This reviewer	All causes of thyroid stimulation merge into asphyxia which is antecedent to the rise of basal metabolism	Compensatory for asphyxia. Unduly increased basal metabolism is overcompensation.

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Pediatric Clinics

THE DEPARTMENT OF PEDIATRICS JOHNS HOPKINS UNIVERSITY

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THE department of pediatrics at Johns Hopkins is housed in the Harriet Lane Home for Invalid Children which is an integral part of the Johns Hopkins Hospital. It provides inpatient and outpatient facilities for sick children, teaching facilities for medical students, and laboratories for the members of the departmental staff.

HISTORICAL

Prior to 1909 the pediatric department was in charge of Dr William D Booker. It was a subdivision of the department of medicine and functioned in two small rooms. It was solely an outpatient department having no beds of its own although a few children were admitted to the adult wards.

In 1909 Dr Clemens von Pirquet was called to the chair of pediatrics, and the department became a separate unit. It still lacked beds, however, and only the outpatient department provided material for clinical work, teaching, and study. Dr von Pirquet drew up the plans for the present building but before it was completed, he relinquished his post and returned to Europe.

In 1912 the Harriet Lane Home was opened and Dr John Howland became professor of pediatrics. The present development of the department dates from that time. Dr Howland had studied in the clinic of Czerny at Strasbourg and was deeply imbued with the idea of a "university clinic" in which clinical study, teaching and the laboratory investigation of disease were carried on under the same roof under the aegis of the university. He may be said to have founded the first pediatric clinic of this kind in the United States. The "full time" plan, which was adopted in 1914, undoubtedly contributed to the fulfillment of this idea.

Since 1927, a year after Dr Howland's death, the department has been in charge of Dr Edwards A Park. In the twenty-two years that have elapsed since it began to function as a complete unit there has been a steady growth in the amount of clinical material and a corresponding increase in the size of the staff. There have been various changes in the plant itself and in the organization. However, only the department as it exists today will be described here.

PLANT

The building and equipment of the Harriet Lane Home have been described in detail in an article by Dr Weech.¹ At the present time an average of seventy patients, both white and colored, are treated in the wards, and there are also twelve rooms available for private patients. Children are admitted up to the age of four years, but approximately one-half of these are under two years of age. Most of them are medical cases, only a small proportion being surgical. Adjoining the

¹Associate Professor of Pediatrics, Johns Hopkins University

Harriet Lane building proper are three special pavilions designed for the cure of patients with contagious diseases. Because of inadequate funds these buildings have never been operated at capacity for that purpose. They have been used as wards only in times of special epidemics, patients with contagious disease being ordinarily referred to the city hospital.

The outpatient department handles an average of one hundred patients daily, these are seen almost entirely by appointment. A social history is taken by the admitting clerk on all new patients. The dispensary is manned very largely by the intern staff, although medical students, a few local practicing physicians, and occasional postgraduate students also work there. The physician in charge of the dispensary is a member of the department staff who devotes his entire time to that task. He reads all the histories each day, personally supervises a large part of the clinical work, and directs the activities of the social service in regard to dispensary patients.

In recent years a number of special clinics have been developed in the dispensary for purposes of special study or special treatment. Those in operation at present include clinics for infantile tuberculosis, congenital syphilis, epilepsy, heart disease, and the behavior problems of childhood. Smaller clinics for diabetes, allergic diseases, rickets and bone deformities, organic nervous diseases, and dental problems are also organized. A clinic for examination of children brought in by various social agencies, prior to placement in homes or institutions, is also in operation. Other special clinics have been called into being from time to time, as one or another problem was under investigation. The dispensary is so organized that students, internes, and others who work in the general dispensary can have access to the patients in the special clinics as well.

SOCIAL SERVICE

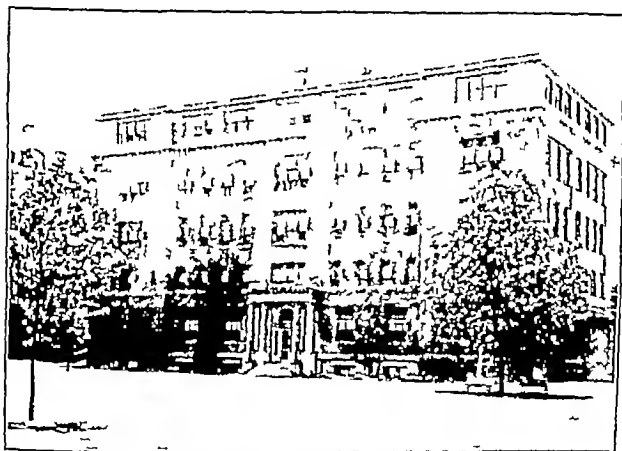
The social service of the pediatrics department has been extensively developed during the past fifteen years. Its staff consists of a head worker and nine full time social workers, in addition to these, there are five or six part time volunteers. Some of the workers are attached to special clinics such as the syphilis, tuberculosis, cardiac, the behavior and the epileptic clinic, while others handle the general cases from the dispensary and wards. The community served by the hospital contains a large colored population and social problems are almost omnipresent. During the past year more than one thousand individual patients were referred to the social service department. More than five thousand home visits were made by workers during the year.

The social service gives invaluable assistance to the medical staff in the treatment of patients and in the study of disease. It supervises home treatment, a service for which the need has been particularly acute lately because of limitation of hospital beds. It obtains information in regard to the home environment which is often of great value in guiding the medical staff in regard to admissions and discharges from the wards. It provides a follow up service for ward and dispensary patients. It is constantly in touch with other institutions and various charitable and social agencies throughout the city and state. Through it arrangements are made for transfer and placement of patients, and for financial or other relief when needed. The social service is a valuable asset in collecting patients for teaching purposes, and lastly it performs an essential function in the clinical research studies which are in progress by collecting information on the home environment, supervising home treatment, and ensuring return visits to the hospital.

A very close relationship is maintained between the medical and the social service activities. Representatives of the social service make regular visits with the house staff and the social service record is incorporated in the medical history.

AFFILIATIONS OF THE DEPARTMENT

The pediatrics department is a unit in a compact medical center which includes the Johns Hopkins Hospital, the School of Medicine and the School of Hygiene and Public Health of Johns Hopkins University. Embryologic laboratories of the Carnegie Institute of Washington are also housed in the medical school buildings. This proximity makes for close cooperation between the different departments both as regards consultations and treatment.



The Harriet Lane Home for Invalid Children.

An arrangement is in force whereby babies born on the obstetric service are routinely examined by a member of the pediatric staff who also serves as a consultant when special pediatric problems arise on that service.

A well baby clinic is not operated by the pediatric department, but close relations are maintained between the Harriet Lane Dispensary and a series of Welfare Centers scattered over the city operated by the Babies' Milk Fund Association and the City Department of Health. Sick infants are referred from these Welfare Centers to the Harriet Lane Home, and patients who have recovered from an illness are referred to the neighborhood welfare clinic.

A close contact is maintained with the municipal hospital for contagious diseases. This is used as a teaching hospital for students in the Johns Hopkins Medical School. Each intern on the pediatric service spends six weeks of his time at this hospital.

There are two convalescent homes, situated in the suburbs of Baltimore, with which the pediatric department is intimately connected, and to which many ward patients are discharged for convalescent care. The St. Gabriel's Home for Con

valescent Girls is given medical service by members of the department of pediatrics. The Happy Hills Convalescent Home for Children, which cares for both boys and girls, is provided with a medical visiting staff who are either past or present members of the pediatric staff.

PERSONNEL

The resident house staff consists of ten members: a resident, two assistant residents and seven house officers. The latter are appointed for one year only, the resident and assistant residents often retain office for a longer period. The house officers, in addition to the care of their ward patients, work regularly in the outpatient department.

The members of the departmental staff who do not live in the hospital number an additional twenty-two persons: the professor of pediatrics, two associate professors, three associates, eleven instructors, and five assistants. Thirteen of these—the professor and associate professors, two associates, seven instructors, and one assistant—are on the full-time plan, the remainder being practicing physicians who devote a certain amount of time to the institution.

With the exception of two individuals who are working on fellowships in the laboratories, all the members of the departmental staff perform clinical duties either on the wards, in the general dispensary, or in the special clinics. Most of them also devote part of their time to laboratory work.

LABORATORIES

The department is equipped with clinical laboratories, a bacteriological laboratory, chemical and biological laboratories. Pathological examinations are made in the general pathological department, there being no segregation of the pediatric material. The clinical and bacteriological laboratories exist at present only for routine work. Some routine determinations are made in the chemical laboratory. On the whole, however, the chemical and biological laboratories, which comprise the entire top floor of the building, exist for research purposes.

RESEARCH

The problems being studied today are naturally no guide as to those that may be under investigation a few months hence. But, since they illustrate the type of work that is likely to be in progress, it may be of interest to enumerate them.

In the chemical laboratory the problems under investigation include a study of the metabolism of iron, copper, and of blood pigments in anemic states and infections, a study of the magnesium metabolism with particular reference to the decalcifying properties of this element and its relation to the parathyroid hormone, a comparative study of fats from the point of view of absorption, the parenteral administration of fat, studies of the water balance in epilepsy and in states of dehydration. In conjunction with the department of psychiatry, a study is being made of the carbohydrate metabolism in various psychiatric conditions.

Work in progress in the biological laboratory includes an anatomical study of the conduction system of the antricle, the experimental production of lead poisoning and comparisons of various forms of treatment, the occurrence of lead in human blood, a study of the anatomical basis for x-ray changes in the bones in various pathological conditions, a study of the biological properties of strontium, studies of the etiology of pathological calcification, with particular reference to the influence of cholesterol and the parathyroid hormone.

A number of purely clinical studies are in progress. Many of these are minor problems brought up by individual patients. More comprehensive studies are also

under way, particularly in connection with the special clinics. Most of the special clinics include among their functions the collection of statistical data with a view to the more accurate description of disease or the testing of some therapeutic measure. For example, in the tuberculosis clinic a series of infants, infected or exposed under two years of age, is being followed with the greatest care for a fifteen year period. The chief points under investigation are the source of infection, the course and prognosis of infantile tuberculosis, the transition from the infantile to the adult form of the disease. A controlled series of children who cannot be removed from tuberculous environments is being studied to ascertain the protective effect of inoculation with dead tubercle bacilli. In the rickets clinic a prophylactic and therapeutic study of the effective dosage of various antirachitic agents is being carried out in infants and in children with late ricket.

The diversity of the studies in progress bears witness to the policy which has been followed by the head of the department of allowing the various members as much freedom as possible in the selection of their problem for investigation.

TEACHING

Undergraduate teaching in pediatrics is carried out mainly during the fourth year of the medical school curriculum. Third year students are given only a lecture course of seven hours covering elementary principles of infant feeding, and the examination of normal infants.

During the fourth year a clinical lecture of an hour and a half is given by the head of the department to the entire class. This constitutes all the required work in pediatrics. However, an elective course is offered and is in point of fact taken by the majority of the class which gives a more intensive training. Students taking the elective work in the Hurst Lane Dispensary under supervision every afternoon for two months, in addition to this they are given an informal clinic during this period for an hour each morning. Arrangements are also made whereby students who so desire can work in some of the well baby clinics in the city.

Staff exercises of various kinds are held regularly, in which the entire house staff and departmental staff participate. Special ward rounds to discuss cases of particular interest are held twice weekly. A staff conference is held once a week at which members of the department or of other departments in the institution discuss problems of current interest. A joint conference with the x-ray department is held once a week in which x-ray films of particular interest are exhibited and discussed. A clinical pathologic conference is held once a week in which recent autopsy material is presented. There is also a weekly history meeting at which recently discharged ward cases are reviewed and discussed.

Formal instruction for postgraduates is not offered at Johns Hopkins. Visiting physicians are always welcome to attend ward rounds, the various staff exercises, and the student clinic. Arrangements can usually be made for work in the outpatient department for those who wish to stay a sufficient length of time.

In requesting this series of articles on pediatric clinics the Editor of the Journal expressed the hope that it might prove of value to the physician wishing to secure a more intensive training in pediatrics. The writer shares this hope. But it seems to him a pity to dilate upon the material attributes of a clinic without mentioning—at least in passing—intangible factors which in his opinion are of far greater importance in determining an individual's choice of a clinic in which to work. In an admirable essay which has been published under the title "The Soul of the Clinic" the late Francis W. Peabody pointed out the attributes of a head of a department which determine so largely the success of the enterprise. What the student of

pediatrics would really like to know about a clinic is what manner of men comprise its personnel. It is the writer's belief that in the last analysis clinics will be judged by their "soul" rather than by their "anatomy" or "physiology."

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Critical Review

CHILD HEALTH 1933-1934

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IT IS the purpose of this review to set forth certain pertinent facts regarding the depression and its effect on child health and on child health services to point out some of the steps that have been taken to stimulate interest in these problems and to attempt to safeguard the health of children in the future. The past winter 1933-1934, marked the fifth of the depression. The accumulative effect on children of inadequate food, too little medical care and lack of security has become more and more apparent. That the facilities for meeting the health and medical needs of children the country over are far from adequate scarcely needs to be said. It may be well however, to remind those who live in centers of population well provided with physicians, pediatricians child health conferences and public health nurses that in many parts of the country there are still numerous communities with little or no such service available for children and that in some sections there are large areas wholly unprovided with any sort of medical or nursing service to say nothing of specialized care for children. Even in normal times the need for more adequate child health work was great the depression has increased it many times.

With the increase in unemployment from 1929 to 1933 there has been a steady and rapid increase in the number of families seeking support through public or private relief agencies. At the same time there has been a vast increase in the need for medical care and for health supervision of mothers and children in families who were unable to pay for such service. An indication of the burden that has been put on public and private funds by this great increase in the relief load is given in Chart 1 which shows the trend in amounts expended from public and private funds for all types of relief in 120 cities and city areas from January 1929, through March 1934.¹ The rapid decrease in the expenditure for relief from November 1933 to January, 1934, may be accounted for largely by the number of individuals taken from relief rolls and employed under the Civil Works Administration. The rise in March 1934 was coincident with the decrease in the civil works program.² A similar chart showing the trend in the number of families receiving relief in these 120 cities cannot be given because duplication in the reporting of families receiving relief from more than one agency has rendered the figures from many communities valueless. Studies of a smaller group of cities for which duplication in counts could be avoided

¹ From the United States Department of Labor, Children's Bureau, and the Department of Pediatrics, Yale University School of Medicine.

indicate, however, that the trend in number of families on relief rolls has, in general, followed fairly closely that of the amounts expended for relief.³

A study⁴ made by the Federal Emergency Relief Administration of the relief situation in October, 1933, showed there were 3,134,678 families and nonfamily persons receiving relief from public funds during that month, involving altogether nearly 12,500,000 persons. The study further showed that 42 per cent of these persons were under sixteen years of age, a figure that was considered particularly significant by the Federal Emergency Relief Administration because, according to the 1930 Census of the United States, children under sixteen years made up in that year only 31 per cent of the total population. In other words,

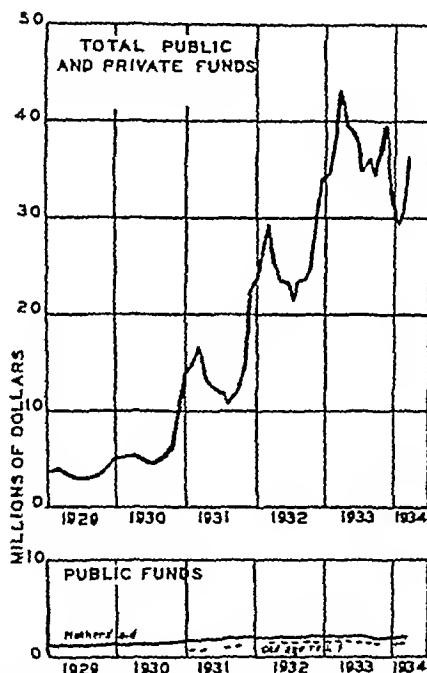


Chart 1—Amount expended from public and from private funds for different types of relief in 120 urban areas in the United States from January 1929 to March 1934

there were in October many more children in the families who sought relief than there were in the families in the United States as a whole. The report shows there were 5,184,272 children under sixteen years of age in these relief families, including 233,822 infants under one year of age and 1,589,480 children from one to five years of age, inclusive. These figures do not, of course, include the children in families of the unemployed who had not sought relief, a group reported by many social and health workers to be in at least as urgent need of health supervision and medical care as the children in families receiving relief.

With such a load thrown on the public and private relief agencies, the tendency has been to spread relief thin, and it is not surprising that it has not been adequate in many instances to meet the food needs of the children or to provide medical care. Actually the amount of relief given

in some communities has been so low that only a very inadequate diet could be provided with little or nothing left for clothing shelter and medical care. In many regions however, the level of relief has gradually been raised. In January 1932 for instance the average monthly relief given in 124 urban areas reporting to the Children's Bureau was \$17.66^a. In January, 1933 it was \$19.37 in 110 urban areas, while in January 1934 the average monthly relief had risen in these same areas to \$22.32^a. Though these figures indicate that there has been a definite improvement in standards of relief during the past two years the relief given in many communities is still far below that required to provide adequate food shelter, clothing, and medical care. In this connection it is encouraging to find reported in the press recently^b that in one large city an average monthly allowance of \$47.78 was given during the month of March, 1934. A continued improvement in the general level of relief given must occur if children in relief families are to be adequately fed.

Medical care for the children in families on relief living in cities and towns has been given to a considerable extent through free clinics and dispensaries where such have already existed. Private physicians, however, have borne a large portion of the burden of this free care, especially in towns and rural communities where no free clinics are available. In this connection it may be pointed out that Perrott, Sydenstricker and Collins²⁰ have shown that the amount of care received from physicians either in practice or in clinics by families who have suffered most from the depression has been considerably less than that received by "their more fortunate neighbors" whose incomes have not been so reduced. In the early fall of 1932, the New York State Temporary Emergency Relief Administration put into effect a plan for payment of physicians, dentists, and nurses for the care of relief families. In the summer of 1933 the Federal Emergency Relief Administration authorized state relief administrations to use federal funds for medical care under a set of rules and regulations drawn up to safeguard the procedures^c. As a result, plans for the giving of medical care to families on relief have been drawn up under these rules in many states by the state relief administrations in consultation with the state medical associations and are now in more or less successful operation. The administrative plans of procedure and the schedules of fees have, of course varied to some extent from state to state. Under these plans medical care may be given to children as well as adults in families on relief but, in general such care has had to be limited to acute conditions or to correcting conditions seriously interfering with growth and nutrition. Some states have not as yet adopted such a plan and, within certain states individual counties may not have done so even though the majority of the counties have. Under these rules and regulations for medical care payment for health examinations of children has not been permitted.

During the third and fourth winters of the depression much interest was shown and many speculations made with regard to the effect the depression was having or had already had on the health, nutrition and medical care of children in families of the unemployed. The continued decline in the infant mortality rates for the country as a whole and for many states and cities and in the death rates from tuberculosis and other communicable diseases were repeatedly cited as evidence that the health of the people of the country was better than ever before. Mortality rates, however, do not provide a complete or adequate measure of the

effect of the depression on child health. The actual condition of the children themselves, their nutrition, their growth and development, and the illnesses from which they suffer must be taken into consideration when judging the effect of economic conditions. Moreover, mortality data are not so collected that comparisons may be made between the rates for those sections of the population that are known to have suffered from prolonged unemployment and the rates for those sections of the population that have continued in full-time employment. Though the number of individuals seriously affected by the depression is vast from the point of view of providing relief, it represents but a relatively small proportion of the total population, and changes in the mortality rate of this group may have been masked by continuation of the general downward trend in that larger proportion of the population that has at no time reached the level of real economic want.

During the second winter of the depression in certain isolated areas where unemployment had been widespread for a number of years, there were found undoubted evidences that children were suffering from lack of food and medical care. At this time, however, though social workers and others in industrial cities and towns and in certain of the drought areas were beginning to come in contact with more and more children who were obviously showing the effects of deprivation, there were no figures available showing the effect of the depression on large groups of children or on the child population as a whole. During the winters of 1931-32 and 1932-33, with the prolongation and intensification of the depression, the effects on groups of children gradually became manifest. Though the data available were to a large extent fragmentary, nevertheless, by the summer of 1933, the weight of evidence that had accumulated^{9, 10, 11, 12, 13, 14} pointed unmistakably to the fact that both malnutrition and illness were increasing among children as a result of the depression. It was, of course, appreciated that figures from one community were not necessarily applicable to another, and because the effects of deprivation were demonstrable in one region, it did not necessarily mean they existed in another. Figures based on the examination of children in families "on relief" could not be applied to children in families not in need. Estimates of undernutrition or malnutrition made by one group of physicians could not be compared exactly with those made by another. During the summer and fall of 1933, three investigations were reported verifying to a great degree previous impressions.

Early in the summer of 1933 a report, "Idleness and the Health of a Neighborhood,"¹⁴ was issued by the Association for Improving the Condition of the Poor in New York City, it was based on the results of two surveys in the Mulberry Health District—one in November, 1930, and one in April, 1932. In its summary the report states "the evidence seems conclusive that in both April, 1932, and November, 1930, the unemployed portion of Mulberry's population suffered more sickness than the employed." In the section dealing with the study of children under six years of age it is pointed out that, for every 1,000 children visited in April, 1932, 259.9 were said to be sick, whereas in November, 1930, the corresponding rate was 91.2, the difference representing an increase of 185 per cent in the sickness reported. Even if colds, which may not have been as well reported in 1930 as in 1932, are eliminated, there remains a rate of 199 per 1,000 in 1932 as compared with 90.2 in 1930. Though the 1932 survey followed an epidemic of measles, the high sick-

ness rate in 1932 cannot be accounted for by an epidemic of any communicable disease at the time of the survey. The total sickness rate for children under two years of age was shown to correspond to variations in economic status of the family. For children between the ages of two and six, however, the association between sickness and the economic situation applied to some diseases but not to others. Malnutrition in this group of preschool children did not appear to vary with adequacy of family support. The investigators point out however, that this latter finding is not consistent with the general trend of the survey findings in 1930 and 1932 which showed an increase in the rate of malnutrition among children under six years of age from 60.3 per 1,000 in 1930 to 99.0 per 1,000 in 1932. Moreover, examinations of preschool children at the Mulberry Health Center by physicians showed an increase from approximately 18 per cent in the years from 1927 to 1929 to approximately 38 per cent in the years from 1930 to 1932. A number of suggestions are offered to explain the apparent lack of correspondence between the rate of malnutrition and the employment status of the household such as variation in physician's diagnosis of malnutrition and the more adequate diet and care given through the Health Center to children in families in the most unfavorable economic status. The conclusion is reached: "In spite of these circumstances, however, child health has undoubtedly suffered in Mulberry during the depression." Furthermore the study showed that the rate for sickness receiving no medical care by physicians in 1932 was four times that in 1930 whereas the rate for sickness receiving medical care increased hardly at all. In April 1932, only one in every four children under six years of age received medical care at any time during the course of the present illness, whereas two out of five of the total sick population studied received such care.

In October, 1933 there was issued the first of a series of reports by Perrott, Collins and Sydenstricker^{18 19 20 21} dealing with a comprehensive investigation of "Sickness and the Depression" in ten localities including the poorer districts in eight large cities, a group of coal mining communities, and a group of cotton mill villages. The findings reported to date are the best statistical data available that have to do with the effect of the depression on health in the United States. Certain of the data are given by age groups and give information about children. The reports so far cover the relation of economic status in 1932, change of income from 1929 to 1932, and employment status in 1932 to the incidence of disabling illness during a three-month period in the spring of 1933 to medical care received, to malnutrition in a group of 1,000 school children, and to birth rate. In addition dietary studies were made of a number of families in each area. The population surveyed was composed largely of families in the wage earning class, a considerable proportion of which had experienced loss of income due to unemployment and wage reductions. The basic data so far reported for five cities¹⁷ show a marked shift in income during the four years studied in 1929, 13 per cent of families were classified as "poor" (annual per capita income less than \$150) and 37 per cent as "comfortable" (annual per capita income \$425 and over) whereas in 1932 51 per cent were classified as "poor" and less than 10 per cent as "comfortable." Study of the illness rate for disabling illnesses beginning within the three month study period showed that among some 34,000 persons studied in eight cities¹⁸ the rate was

nearly 40 per cent higher in 1932 for the "poor" families than for the "comfortable" ones and that, more striking still, the illness rate was more than 60 per cent higher among members of families whose incomes had dropped from "comfortable" to "poor"—the so called "depression pool"—than among members of families who were in "comfortable" circumstances throughout the four years. Analysis of the data by age groups¹⁹ showed that the same facts held true for children as for adults, the total sickness rate for the youngest group being much higher for children of the "depression pool" than for children of the families who suffered no drop in income. Furthermore, the children under 15 years of age among the "depression poor" showed a much higher rate for respiratory diseases (120 per 1,000 children) than did children of the same age in families who remained in comfortable circumstances (55 per 1,000 children). The difference was not evident in the communicable diseases of children, such as whooping cough, measles, mumps, etc. At each age level also, there was a direct relation between the unemployment of the family and the illness rate, the rate for persons in families with no unemployed members in 1932 being lower than that for persons in families with only part-time or no employment.

In the same way the reports²⁰ show that the members of families of the so called "depression poor" received strikingly less care from physicians, either as private practitioners or in clinics, than did their "more fortunate neighbors" whose incomes had not dropped. The difference was largely due to a decrease in the amount of pay care that the "depression pool" received which was not made up for by a similar amount of free care. Moreover, though the "depression poor" received much more free care from visiting nurses and more free hospital care than did their neighbors who remained in comfortable circumstances, they did not receive nearly as much as did the "chronic poor." The authors suggest that the "depression poor" had not made as good connections with sources of free care as had those who had been poor since the beginning of the depression.

Furthermore, it was shown²¹ that the birth rate was highest in families which were without employment or on part-time work in 1932 and that this was true for unskilled, skilled, and salaried workers alike. The birth rate was highest among the chronically poor, but it was also shown to be considerably higher among the "depression pool" than among the families who did not suffer a drop in income. No data on infant mortality rates have been reported.

As part of the investigation, Kiser and Strick²² examined carefully 1,000 school children from families in poor areas of New York City and Pittsburgh in order to study the relation of malnutrition to economic status and loss of income. Only figures for 514 school children examined in New York are so far reported. More than 40 per cent of the children from families in the lowest income group at the time of the investigation in 1933 (less than \$4.00 per capita per week) were classified as having "poor" and "very poor" nutrition, in contrast to only 24 per cent of the children from families in the highest income group (\$6.00 or more per capita per week). The investigators point out also "that a lowering of nutritional status appears to be associated with a drop in family income in as short a time as a year." They state, furthermore, "that the proportion of children suffering from malnutrition in the group examined appears to be considerably larger than the proportion of mal-

nourished children we should expect to find in a nondepression era. While we have no records for other groups of children which are directly comparable with our data, the difference in the prevalence of malnutrition among children of lower income families as compared with that among children from the highest income families in which there has been relatively little change in income since 1929 is definitely shown for the group included in this study.

Studies by Wichl² of the diets of several hundred families in New York City, also made as part of the larger investigation, indicated that, as income declined, the average consumption of each type of food in the dietary was reduced, but the greatest reductions were in the use of milk, meat, fish, eggs, and vegetables and fruits. The resulting diets lacked balance. The diets of families on home relief contained better proportions of the various nutrients than those of work relief families or of families with lowest income not on relief, but the milk supply was somewhat below that recommended for a low income diet.

From these studies it would appear that increase in the rate of disabling illness for children and adults alike, increase in malnutrition among school children, decrease in the amount of medical care received, and increase in the birth rate were closely associated in the populations studied with drop in income during the four years of the depression studied. The investigators warn against general application of these findings to all wage-earning groups until the complete data are analyzed. There has been no report so far on the data from coal mining and cotton mill areas.

A third investigation that has a direct bearing on the question of the effect of the depression on child health and development is one made by Palmer²⁴. The study was undertaken with the purpose of determining whether or not the weights of elementary school children in Hagerstown, Md., differed in 1933 in significant particulars from the weights of children of the same sex and age and living in the same city during the past decade. Comparison was made of the weights of school children in May, 1933, with those of school children weighed in May each year from 1921 to 1927. The study showed first that the average weight of children in the two periods presented no consistent or statistically significant differences and that though the variability of body weight (measured by the standard deviation) was not consistently different for boys for the two periods, that for girls was slightly greater in 1933 than in 1921-27. Comparisons of the percentages of boys and of girls found in 1933 and in 1921-27 to be 12 per cent or more below the mean weight of children in 1921-27 showed no statistically significant differences for boys between the two periods, but did show that if six, seven, eight and nine year-old girls were considered together, leaving out the ten and eleven year-old individuals, there was a significantly higher proportion underweight in 1933. Further study showed that in the totals of 1,245 boys and 1,269 girls there were four fewer boys and forty-one more girls underweight in 1933 than would have been expected had the same proportions been underweight in 1933 in the various age-sex groups as were underweight in the 1921-27 period. It is concluded that the present economic depression is associated with a slight increase in the proportion of underweight elementary school girls.

However, when these same children were classified according to the employment status of their families and according to whether or not they

were receiving relief directly in the home or indirectly through school lunches, differences in weight became apparent. The children in families with no employment or only part-time employment weighed from 15 to 4 pounds less on the average than did those in families of the regularly employed, and the children who received free lunches at school or whose families were receiving welfare aid weighed from 25 to 9 pounds less than did those not eligible for free lunches or whose families did not receive aid. The investigators point out that these differences are approximately the same as those usually found between the higher and lower economic classes and conclude that "a welfare agency which gives its funds toward support of children who average 25 to 9 pounds below the weight of other children in the same community is, in fact, probably giving aid to those children who are actually most in need of it."

Although the weight differences for the total number of children studied by Palmer in 1921-27 and in 1933 are small and appear to show but little effect of the depression on school children in Hagerstown, nevertheless, the differences brought out by him, as well as by others cited by him, between the weights of children in families of the unemployed and underemployed and those of children in families with regular employment are cause for serious concern for the growth and development of many children—not only the five or six million children in families now on relief, but also the many others in families of the underemployed whose financial circumstances have been materially reduced for long periods of time.

CHILD HEALTH APPROPRIATIONS 1933-34

Accurate data regarding the changes in appropriations or expenditures for child health work by private agencies are not available, partly because the cost of child health activities is often not separated from that of other activities and partly because it has not been possible to keep up to date records of the number of public health nurses employed for child health work either in a generalized program or in a specialized one. There have been, however, many reports of reductions in appropriations for nurses and for child health conferences maintained by private contributions. During the year 1933 it has been increasingly difficult for privately supported health agencies to continue their full amount of work done. Furthermore, the increased burden of bedside nursing thrown on these agencies by the depression has affected the volume of child health work. In some public health nursing agencies the urgency of the situation has resulted in reorganization of methods to permit the nurses to give more child health instruction to mothers in group conferences than at home visits.

Exact information is also lacking with regard to changes that have taken place during the past few years in appropriations and expenditures for maternal and child health by public agencies in cities, towns and counties. Decreases in public appropriations for all public health activities have, however, occurred in many cities and towns. Reports made to a committee of the American Public Health Association²⁵ show that there were reductions in appropriations in 1933 as compared with expenditures in 1931 in fifty-six out of sixty-two of the large cities reporting. These reductions amounted to 18 per cent on the average and ranged from 47 per cent to 2 per cent. That these and similar reductions in smaller cities and in towns have affected the child health work

in many instances as well as other aspects of the public health program is, of course, very probable. When reduction of appropriations are such that public health nurses are dismissed the number of maternal and child health conferences reduced, and medical examinations of school children eliminated, as has happened in many communities, much of the value of many years' work in the establishment of such health services is lost. Reports of reduction in the number of school nurses employed by local boards of health or education have come from many parts of the country. Many counties that formerly were able to support at least one public health nurse for maternal and child health work either in a generalized or specialized program, are now without any. Taking into consideration, moreover, the fact that in certain large counties in some of the rural states there may be but one physician, or none at all, to cover several hundred square miles of territory it is perhaps easier to appreciate the value of even one public health nurse in such a community and what her loss means in terms of maternal and child health work alone.

Data with regard to changes in appropriations and expenditures by state health departments for child health activities are more complete. Recent reports received from state health officers give the following information regarding expenditures for child health activities in 1932 and 1933 and appropriations for the current fiscal year 1934.

Expenditures in 1933 as compared with those of 1932 showed an increase in three states, no change in twelve states, and a decrease in twenty-eight states, in four of which the appropriation was completely eliminated in 1933. Five states had no appropriation for child hygiene in 1932 or 1933.

The appropriations for 1934 as compared with the expenditures for 1933 showed an increase in six states (three increases over the budgets of 1932 and 1933, and three partial restorations of cuts in 1933), no change in fourteen states and a decrease in nineteen states (nine being the first reductions since 1932, nine additional to cuts in 1933, one partial withdrawal of a 1933 increase).

From 1932 to 1934 there was a net increase in only four states, no change in two, a net decrease in thirty-seven. Five states had no appropriation in 1932, 1933 and 1934 and four others had none in 1933 and 1934. The net decreases for the thirty-seven states ranged from 100 per cent in four states to 5 per cent in one state.

The actual expenditures in 1932 and the appropriations for 1934 for the maternal and child health activities of the state departments of health are shown in Chart 2 for the forty-eight states. The chart shows that for the current fiscal year 1934 there are nine states with no appropriation for child health work (Arkansas, Colorado, Indiana, Nebraska, Nevada, Oklahoma, Utah, Vermont, New Mexico has no special appropriation) eight with an appropriation of less than \$5,000 (Alabama, Idaho, North Dakota, Oregon, South Carolina, Tennessee, Washington, Wyoming) six with \$5,000 but less than \$10,000 (Florida, Iowa, Kansas, Louisiana, South Dakota, West Virginia), fourteen with \$10,000 but less than \$30,000 (Arizona, California, Connecticut, Georgia, Kentucky, Maine, Maryland, Mississippi, Missouri, Montana, New Hampshire, North Carolina, Ohio, Rhode Island), six with \$30,000

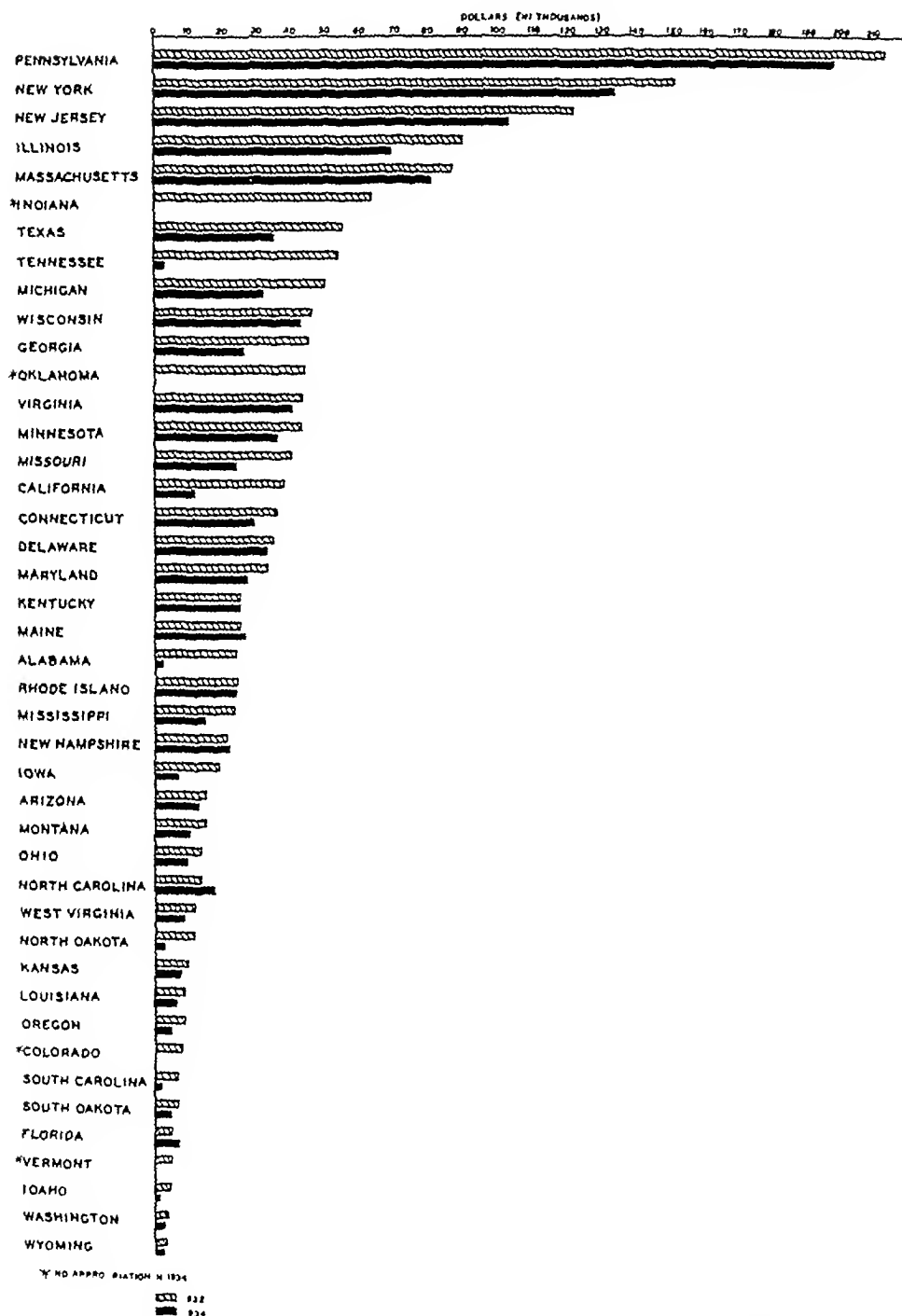


Chart 2—State appropriations (in thousands of dollars) for maternal and child health activities in 1932 and 1934

Five states—Arkansas, Nebraska, Nevada, New Mexico and Utah—had no appropriation from 1932 to 1933.

Crosshatched bars show appropriations in 1932. Solid bars show appropriations in 1934. Asterisk indicates no appropriation in 1934.

to \$50 000 (Delaware, Michigan, Minnesota, Texas, Virginia, and Wisconsin) and five with more than \$50,000 (Illinois, Massachusetts, New Jersey, New York, and Pennsylvania)

There is little need for comment either on the reductions in these state appropriations or their present size. If leadership is to be taken in state wide child health activities by the state departments of health adequate appropriations must be made to provide trained personnel. In only eighteen states is there as much as \$25 000 appropriated annually for this work. In this connection it may also be pointed out that in only twenty two states is there at the present time a full time physician in charge of the division of child hygiene in nine others either a nurse or a physician who is largely occupied with some other phase of public health work is in charge of child health activities. Seventeen states have no special division of child hygiene.

CHILD HEALTH ACTIVITIES 1933-1934

During the year 1933 and the winter of 1933-34 child health activities have been continued on a state wide basis to the extent permitted by the appropriations made to the state departments of health for this purpose or as unassigned funds have been used. The usual type of activity has been continued as far as possible by each state and in a few states there has been no decrease in personnel or scope of work. In several special surveys have been undertaken in selected counties or of special groups of children to determine the need for more extensive work. The large reductions in funds during the last two years, however, or their complete elimination, has seriously handicapped the maternal and child health work in a number of states. It has been necessary to reduce the staff of supervisory and field nurses in many states, to cut down or eliminate the prenatal and child health conferences, to curtail to a great extent the educational work with parents, students and others. The reduction in funds for travel has, in certain of the larger states, seriously handicapped the work of the personnel that have been retained on the staff. There is no way of estimating at present the total loss to child health through the elimination or reduction of these state wide educational and advisory activities or through the reduction of medical examinations and follow up care by nurses for mothers and young children in states and communities where but little of such work is still carried by local groups. At the very time when increased need among families of the unemployed has called for increased help of the type that can be rendered to counties and local units by a well-staffed state child hygiene division the reductions in personnel and funds have occurred not only preventing new work from developing but often eliminating the routine activities. The fact that communicable diseases have been controlled and that mortality rates have continued to decrease speaks well for the maintenance of public health activities that have to do with these phases of health even in the face of very great odds. Those aspects of child health work however, which are most seriously interfered with by the reduction in the activities of the child hygiene division, that is, work in nutrition, general hygiene and mental health, are the very ones in which an increase is made imperative by the economic depression.

PENNSYLVANIA EMERGENCY CHILD HEALTH ACTIVITIES

Because of reports of serious increases in malnutrition among children in many areas in Pennsylvania that were brought to him by the state medical society, the State Board of Health, and the Emergency Relief Board, Governor Pinchot called together a large number of individuals interested in children for a conference on malnutrition early in February, 1933. The facts presented at this conference regarding the great increase in numbers of families on relief and the reports of increasing malnutrition led the Governor to ask the Pennsylvania Medical Society to nominate persons for appointment by him to state and county Emergency Child Health Committees and to formulate a plan and direct the work necessary to meet the situation.²⁶ The state committee included representatives of the State Medical, Dental, and Nurses Associations, the Academy of Pediatrics, the State Emergency Relief Board, and a number of other professional and lay groups interested in child welfare, nutrition, and other special health fields. County committees, similarly composed with a member of the County Medical Society as chairman and a member of one of the women's organizations as vice chairman, have been organized during the past year in thirty-nine of the sixty-six counties of Pennsylvania, exclusive of Philadelphia. In thirty-seven counties programs of health examinations are in progress.^{27, 28} To assist the chairman of the state committee in organizing these county committees and in getting the work under way, a physician was appointed as full-time vice chairman.

The program of the Pennsylvania Emergency Child Health Committee consists, first, of child health examinations with appropriate follow-up to correct the physical defects found and, second, of an educational program in the field of nutrition conducted through the medium of home economics committees in the counties. The first procedure of each county committee has been to organize health examinations of children in families on relief, located through the county Emergency Relief Boards, and of children in families on the borderline of relief. More than 30,000 such children had been examined by physicians up to February 1, 1934, largely in their private offices. An examination form including necessary data for a "study of the entire child" was prepared by the state committee for the use of physicians in each county. Analysis of the first 26,000 records showed that 27 per cent of the children examined were suffering from malnutrition, ranging from 5 per cent of the group examined in one county to 40 per cent of the group in others. In ten of the twenty-seven counties more than 30 per cent of the children were reported as undernourished. A large number of children were found to be in urgent need of tonsillectomy and of dental care, and a great majority of all children examined had never been protected against diphtheria. Of children under six years of age, 79 per cent had not been protected against diphtheria, and 80 per cent were not vaccinated against smallpox. In all of the organized counties active steps are being taken to insure better diets for the undernourished children, to arrange for dental care, for tonsillectomies, and for immunization. Special efforts are being made to reach all pregnant women on relief rolls and to arrange for the necessary prenatal care and physicians' examinations.

The work of the home economics committees is largely educational. The committees include extension workers, teachers of home economics

and dietitians. Demonstrations are held in groups and at home to show mothers how to prepare and use the foods provided by the Emergency Relief Board so as to provide a well balanced ration for the children and to make the foods provided last out the week. In some counties the services of these committees are also given to families on the borderline of relief.

In a recent report²⁶ the chairman of the committee pointed out "One of the most outstanding accomplishments of the Emergency Child Health Committee has been the bringing together of all interested agencies within the counties under medical leadership. It has smoothed out the differences which far too frequently exist between these agencies, it has established a community of interest, it has eliminated duplication of effort, it has enabled us to increase the effectiveness of all groups and it has established a child health consciousness within the counties, which gives great promise for the health status of Pennsylvania's children in the years to come.

CHILD HEALTH RECOVERY PROGRAM

On the call of the Secretary of Labor a national conference²⁷ was held in Washington, October 6, 1933, under the auspices of the United States Children's Bureau for the purpose of stimulating public and professional interest in the health of children who had suffered as a result of the economic depression and of making sure, while plans were being formulated to bring about economic recovery, that the health needs of children should not be overlooked. Appreciating the diversity of organizations, both public and private, that have an interest in the problems of child health, the Secretary of Labor appointed an Executive Committee²⁸ to consider the objectives of a National Child Health Recovery Program and to make recommendations to the conference. The committee met in all-day session a month before the conference and discussed in detail the objectives and possible plans of procedure of national and state programs. Though the Federal Relief Administrator was unable himself to be present the question of providing adequate home relief for families in which there were found to be undernourished children and medical care for children in families receiving relief were discussed fully with his representative.

The nucleus of the conference was made up of representatives from forty-three state health departments. In addition there were present representatives from national and state associations of medicine, pedi-

²⁶The members of this committee were: Mr. Harry L. Hopkins, Federal Relief Administrator; Dr. Hugh S. Cumming, Surgeon General, Bureau of the Public Health Service, Department of the Treasury; Dr. Louise Stanley, Chief, Bureau of Home Economics, Department of Agriculture; Dr. George F. Zook, Commissioner, Office of Education, Department of the Interior; Dr. Frederick D. Stricker, President of the Conference of State and Provincial Health Authorities and Executive Secretary, Oregon State Board of Health; Dr. A. J. Chesley, Secretary of the Conference of State and Provincial Health Authorities and Executive Officer, Minnesota State Department of Health; Dr. Elizabeth M. Gardner, Director, Division of Maternity, Infancy and Child Hygiene, New York State Department of Health; Dr. Mary Riggs Noble, Chief, Pre-school Division, Pennsylvania State Department of Health; Dr. Lillian R. Smith, Director, Bureau of Child Hygiene and Public Health Nursing, Michigan State Department of Health; Mr. Homer Polka, Secretary, State Charities Aid Association, New York City; Dr. Kenneth D. Blackfan, Professor of Pediatrics, Harvard Medical School and Member of the League of Nations Committee on Malnutrition and the Depression; Miss Katharine F. Lenroot, Assistant Chief, Children's Bureau, Department of Labor; Dr. Martha M. Elliot, Director, Division of Child and Maternal Health, Children's Bureau, Department of Labor, and the following members of the Advisory Pediatric Committee of the Children's Bureau—Dr. Howard Childs Carpenter, representing the American Child Health Association; Dr. Samuel McC. Hamill, representing the American Academy of Pediatrics; Dr. Julius Hess, representing the American Medical Association; Dr. Richard M. Smith, representing the American Pediatric Society.

atrics, dentistry, public health, nursing, home economics, education, relief, public welfare and social service, representatives from many lay organizations, and various individuals interested in the fields of child health and nutrition

The following objectives and recommendations of the Executive Committee were summarized and presented to the conference

"After consideration of the evidence available with regard to the present health needs of children your committee recommended that a program be instituted that should have the following objectives

First The location of undernourished children.

Second The initiation and development of plans to overcome, as far as possible, existing malnutrition and the prevention of its further progress through dietary measures and in so far as necessary the institution of corrective medical procedures.

"To promote such plans as may be decided upon as necessary to meet situations within different states and communities it became evident to the committee that it would be necessary to have the full and complete cooperation of the state and local departments of health, welfare, and education, the national, state and local emergency relief administrations, the state and local medical and dental societies together with the official and nonofficial national, state and local agencies concerned in the promotion of public health and child welfare

"To facilitate such cooperation, the committee recommends the organization of state, county, and local committees, each committee being so constituted as to include in its membership representation from each of the official and, so far as seems advisable, the nonofficial groups above indicated

"In communities where groups similarly constituted are already organized to further the objectives of the program, the continuance of their work should be encouraged and supported

"For the further fulfillment of these plans the committee makes the following suggestions

1 Due consideration should be given to the needs of children in families on relief and those in families who though not on relief are nevertheless in need

2 Under the term children, infancy, early childhood, the school child and the adolescent should all be given consideration.

3 A physical examination form with accompanying interpretive information shall be issued by the Children's Bureau to insure a degree of uniformity in procedure.

4 Provision should be made for the payment of a small fee for such physical examinations Fees for the necessary correction of defects should also be provided Previous experience has shown that the payment of a small fee assures a greater degree of uniformity of examination and expedites the effort "

Previous to the conference, the question of the payment of fees for health examinations of children in families on relief was taken up with the Federal Relief Administrator Though the value of the payment of such a fee in promoting health examinations as part of the Child Health Recovery Program was appreciated, it was decided that authorization for such payments could not be given Authorization for payment for school

lunches from federal unemployment relief funds was approved, however, and announcement made the day before the conference was held.

It was pointed out at the conference³⁰ that, in proposing a nation wide effort to locate malnourished children, it was not the purpose of the Children's Bureau to recommend a program of investigation or research to determine the incidence of malnutrition or the extent to which it had increased in recent years but that the Bureau was concerned solely that ways and means be devised whereby individual children suffering from lack of proper food or medical care might be located and their needs supplied hoping moreover, that the effort might also stimulate communities and states to a realization of the importance of adequate diet and care for all children whose families have been suffering from economic disaster. It was further pointed out that communities would be encouraged to undertake the examination of children from those groups of the population in which the undernourished are most likely to be found, namely, the families on relief and the families who though not yet on relief are nevertheless, in need. Various plans of procedure for state-wide and local programs³¹ were presented at the conference, including that already in operation in Pennsylvania the New Jersey plan for the joint organization of State Medical Society and Bureau of Child Hygiene of the State Department of Health through which, it was believed, a program could be undertaken and in addition a suggested plan of organization under a State Health Department giving details of co-operation with various state departments and other agencies and of necessary committee arrangements for putting the program into effect.

Following the conference, the Children's Bureau made available three physicians for consultation work with various state groups and later added to its staff two other physicians, both of whom were experienced in the organization of state wide child health activities. In addition, the American Child Health Association loaned the services of their medical director for part time for three months. In assisting to formulate programs for the different states no fixed plan of procedure has been followed and cognizance has been taken of the variations in the needs of the states, the present organization for child health work official and nonofficial, the personnel available for state or county work, the ability of state and local groups to organize and finance further activities and the assistance that could be obtained from state and local relief administrations and from nutrition workers to insure adequate diets. Joint action on the part of the child hygiene divisions of state departments of health with state medical associations and pediatric organizations has been sought wherever feasible and state committees or councils on child health have been formed in a number of states. These committees have usually included in their membership representatives from the state health departments the state medical, pediatric, and dental associations the state nurses associations (especially the public health section), the state relief administrations the state departments of public instruction, the extension services nonofficial agencies active in the field of public health or child welfare and lay organizations such as the parent teachers' associations, women's organizations, farm bureaus, etc. In some cases groups of individuals have come together less formally, largely with the purpose of getting a plan under way. Where, however, formal state or local committees have been organized the plan of procedure has usually been more effective. This is especially true in the development

of local community plans. In many counties the local committees have been instrumental in developing strong public opinion in favor of a permanent program for child health. These county or community committees have been variously organized—sometimes by the county medical society, sometimes by the county relief administrator or health officer, sometimes by a public health nurse or interested lay group—but in each case effort has been made to have all interested professional and lay groups represented. The appointment of subcommittees on medical procedure has been urged.

The value of repeated health examinations by physicians as a major part of a child health program was emphasized at the Child Health Recovery Conference and a program of examinations was urged, not for the collection of statistics, but as a part of the child health service that should be available in any community. Since it was not possible to provide a fee for such examinations, it was, of course, obvious from the first that it would not be practical to attempt to arrange for medical examinations of all children and various methods of selection of those most in need were discussed by the executive committee and later at the conference. The recommendation of the committee that consideration be given to children in families on relief and those in other families in need though not on relief was made partly with the idea of confining the examinations, certainly at the start, to a group that was definitely in need. It was also clear that some other selective measures would have to be applied. To this end the plan that had been tried in Detroit, that of having the school-teacher make the initial selection on the basis of her observation of the child and her knowledge of his home conditions was described at the conference. A physical examination form that allowed for two examinations and that stressed the nutritional aspects of the child's physical condition was provided by the Children's Bureau for free distribution to those states or communities that wished to use it. In some places this form has been used by the nurse who has checked certain items at her inspection and later by the physician when he made his examination.

The two chief handicaps to the development of state-wide plans has been the lack of full-time medical and nursing personnel and the difficulty of arranging for correction of physical defects. In those states where experienced physicians and nurses have been available for direction of the work and where state-wide programs had been carried successfully in previous years, the development of a plan of procedure was relatively simple, but even in some of the best organized states the actual carrying out of a program has been difficult because of the great reduction in state and local personnel. The need of a full-time physician to organize a program has been fully appreciated especially in states where there is no regular state director of child health activities. The success of the work of the Pennsylvania Emergency Child Health Committee is due in no little measure to the fact that the chairman has been able to devote so large a portion of his time to the work and that a full-time physician, experienced in public health procedure, was engaged for the work of organizing the county medical society committees.

The lack of public health nurses who could assist in local organization, in the preliminary selections of children for medical examination and in the necessary follow-up was perhaps the greatest handicap to the development of a program. With the inauguration of the Civil Works

Service Administration in the middle of November, however, and the possibility of employing nurses for child health work great impetus was given to the whole Child Health Recovery Program. In a few states individual nurses were employed and put to work under various local projects before the end of November, and in one state at least where the need was known to be very great more than two hundred nurses were at once employed by the State Relief Administration under the supervision of trained public health nurses for a state wide program that had to do largely with the nutritional needs of children.

Because of administrative difficulties in the selection of nurses and the provision of proper supervision and because of uncertainties with regard to the availability of funds there were many delays in putting nurses to work. At the request of the Federal Civil Works Administration, the United States Children's Bureau agreed to act in the capacity of consultant in the organization of special state wide child health nursing projects. During December and January such projects were organized in twenty-eight states under the state departments of health. In at least twelve additional states nurses were employed on a state-wide basis under the supervision of the state health department, the state department of education or the state relief administration and in each some child health work formed part of the nurses' program. In several it formed the major part of their work. Altogether it is probable that nearly two thousand nurses, including approximately 200 qualified public health nurses as supervisors, were employed for varying periods of time during the months from January to May on some phase of child health work. Since the very great majority of these nurses had no previous training in public health work emphasis was laid on the necessity of limiting their activities to some simple aspect of child health work, one for which definite and detailed instructions could be given in preliminary group conferences and in individual conferences.

A program of school inspections and consultations with parents and teachers with the idea of selecting those children most in need of more adequate diet or of medical examinations and care was recommended for these nursing projects. In many of the towns and rural areas to which these nurses were to be sent the school was the logical center to which parents could come to talk over the needs of their children. Younger children have been brought to the school in many instances by the parents for consultation with the nurse. Arrangements with county relief administrators for the provision of milk or more adequate home relief, with nutritionists and extension workers for the development of a school lunch program, or educational work with parents and with local physicians for medical examinations and care have been important parts of the nurses' work in many communities. In a number of states a program of prenatal care especially among women in families on relief and others in need has been included and in a few, work with midwives.

The assistance and advice of extension workers, nutritionists, and teachers of home economics has been obtained in many states and communities. The authorization by the Federal Relief Administrator of the expenditure of federal funds for school lunches for children on relief gave great impetus to the establishment of hot lunches in schools in many states. Though theoretically home relief should be such as to provide adequately for children without having to supplement their diet with a school lunch, the provision of a well planned meal in school, including milk, has unquestionably gone a long way to overcome exist

ing undernutrition and to prevent its development in many thousands of children this winter. In this school feeding program, effort has been made to reach the so-called "borderline" cases, with a view to the prevention of serious malnutrition, rather than to feed only those known to be already in serious condition.

Though in general, emphasis has been placed on nutrition and medical care of children, immunization programs have also been carried in some communities and have formed the chief objective of the nurses' projects and, indeed, of the winter's child health program in several states. In at least two, state-wide programs of diphtheria immunization have been developed by the state medical associations working with the state health departments through the county or district medical societies. Nurses have been employed to assist in these immunization campaigns and in some communities have made house-to-house canvasses to determine the need for immunization among children.

Though for various reasons arrangements for medical examinations of all children who were in need of them have so far been impossible, nevertheless, many individual examinations have been arranged, much medical care has been given, and the diets for many children have been improved as a result of these programs. In some states active cooperation with state and county medical societies or with groups of physicians or individual physicians has resulted in a large number of examinations and in plans for the medical care of children found to be in need.

In those states where the relief administration has adopted a plan under the Federal Emergency Relief Administration rules and regulations governing medical care for families on relief, payments for the correction of medical defects seriously interfering with the child's nutrition or growth are being authorized, and some medical care is being given. Because of the fact that as a rule only emergency work is authorized, many needs are not being met that should be taken care of at once. Unless some plan is adopted in states not yet provided with one and unless there is some liberalization of the conditions under which medical work for these children on relief can be carried out, it is to be feared that many children will ultimately seriously suffer from lack of care, especially those in communities and rural areas where clinics are not available. That funds should be provided for the medical care of children who are sick or have remediable defects that interfere with nutrition and growth would seem to be a charge on the resources of state and nation that is a close second to that of providing food and shelter. Not less important, however, is the provision of funds to insure adequate health examinations for children in families unable to pay for such care.

Reports as to the number of children inspected by nurses, examined by physicians, or immunized against diphtheria or smallpox and of the number of children cared for or given school lunches are not yet available for many states, but those that have come from a few indicate that a considerable amount of work has been accomplished during the winter. For instance, one state that has concentrated on diphtheria immunization reports more than 100,000 immunizations completed, another state that has concentrated on nutritional activities reports for a period of five months more than 89,000 inspections by nurses, more than 20,000 medical examinations, and over 100,000 children regularly fed school lunches. From another state comes the report that 70

school children have been given lunches daily for a period of several months. Plans to continue the employment of nurses for maternal and child health work are being worked out in a number of states and special emphasis is being placed on work with children and mothers in families on relief and in other families in need because of unemployment. To safeguard the quality of work as far as possible, public health nurses will be employed whenever available and in all cases trained or experienced public health nurses will be continued as supervisors.

It is, however, too early to attempt to record accomplishments, and complete figures will probably never be available. Impetus has been given to child health activities in nearly all states and in many individual communities. Many different types of work have been undertaken. Certain states that in recent years have had no state-wide organization for child health work have been able to form committees and, with the aid of the state relief administrations and other state and local organizations, have developed child health activities in many counties. In two states there have been appointed directors for the divisions of child hygiene in the state departments of health, one to fill a vacancy, the other a new appointment. In one state where there is no division of child hygiene a pediatrician has been given a temporary appointment as director of the Child Health Recovery Program serving under the State Relief Administration. In eleven states where there were no directors of public health nursing in the state departments of health, qualified public health nurses were appointed by the state Civil Works Administrations as directors of public health nurses and in most cases, assigned to the state departments of health to direct the child health and other nursing programs. In a majority of states the child health programs have been organized on the basis of health service to mothers and children. In a few special surveys have been undertaken to determine the need. Where such surveys have been made, the need of more adequate food and more medical care has for many children been demonstrated, and the desirability of extending the service has been shown.

CONCLUSION

During the year that has just passed several points have become clear. The enormous shift that has taken place in the past five years from the ranks of the employed to the ranks of the unemployed or underemployed and the subsequent inevitable lowering of standards of living are in themselves sufficient cause for concern regarding the present and future growth and development of the five or six or more millions of children affected. Moreover there would seem to be little doubt any more that the depression has been having an adverse effect on the health and nutrition of many of these children. Since the effects are apparently cumulative, it is likely that they will continue to be felt for a considerable period after the depression has passed unless more active steps are taken to combat them than are possible with the present limited child health budgets and the relatively low standards of relief still prevalent in many communities. Joint action on the part of health and medical groups, together with those responsible for relief, should be taken to make certain that all children—especially those in families on relief and those in families who, though not on relief, are nevertheless in need because of unemployment—are given adequate diet, proper health supervision, and medical care. In such joint planning pediatric

tricians should be actively interested, whether in an official or nonofficial capacity. That sufficient personnel may be available to provide proper health supervision for these children, concerted effort should be made to reinforce and strengthen state, city, and county health appropriations for maternal and child health activities. The present reductions in state appropriations bear hardest on the communities that can least afford to be deprived of these activities—the smaller towns and rural areas. Such communities often have serious maternal and child health problems, and yet frequently they are the most poorly equipped to handle them.

The various efforts that have been made during the past year to strengthen regular child health activities, to reinstate certain of those that have been lost, and to provide medical care for children in families who cannot provide it for themselves should be sustained, and plans for further developments should be worked out jointly by professional and lay groups. To insure adequate diets for children, there must be not only adequate relief for those who need it, but there must be an extension of the educational aspects of the nutrition program.

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American Academy of Pediatrics

Proceedings

REPORT OF THE COMMITTEE ON HOSPITALS AND DISPENSARIES

(CONTINUED)

NURSING

An analysis of the nursing organization of the thirty five children's hospitals in the United States and Canada has been made. Again the questionnaire method fails to give in many instances a complete picture, but in general has enabled us to secure a fairly good idea of the relative efficiencies of these various schools of pediatric nursing.

Fourteen hospitals maintain their own complete schools. As will be shown in detail later, all of these do not give complete nursing courses, but offer only a three months' course as part of a general hospital system or for affiliates from other hospitals. Among these fourteen schools of pediatric nursing only six have fifteen or more probationers. One has as high as forty seven, but most of them are not large schools. However, twenty eight hospitals report that they train student nurses. The number in training at any one time varies from 17 to 176. Only five institutions report 100 or more student nurses in their schools. Seventeen have less than fifty, and eight have from twenty to thirty. These figures indicate that these schools will not produce a very large number of nurses well trained in pediatric nursing.

The length of the courses varies from three months to three years, depending upon the type of school. Eleven hospitals offer a three year course in pediatric nursing. Twenty four offer only a three months' course, and this is usually provided for affiliates from other hospitals, or as part of a general hospital course. All hospitals except two have affiliations with other institutions for special training in pediatrics. There are four hospitals which offer pediatric training only to graduate nurses. Only seven hospitals offer a course for the training of nursery maids.

Only twelve hospitals indicate that they have special rooms or wards for premature infants. Four report that they combine the infant and premature wards, quite probably in these instances a special room is set aside for the prematures, otherwise the arrangement would certainly not be favorable for the well being of the premature baby. Six hospitals report that they do not admit premature infants, and ten did not reply. Usually the number of premature infants receiving care at any one time is two or three. One institution reports as many as nineteen receiving care at one time. The usual nursing assignment in these wards, or rooms, is one day nurse and one night nurse for a duty term of from one to four weeks.

On the infant medical wards we note that the proportion of day nurses to patients is usually one to two or three, and night nurses one to ten or fifteen. The average number of patients in these wards is from twenty to thirty. One hospital reports a night nurse to patient proportion of one to three, and one hospital as high as one to thirty two. Unquestionably the number of nurses assigned to respective wards should depend largely upon the severity of the various illnesses on that ward.

and the amount of care the patients might require. These figures represent average normal conditions and, although the questionnaire as worded could not tell us, we feel sure that in most instances the nursing force would be increased as needed.

The day assignments are in periods of from two to four weeks in eleven hospitals, and from six weeks to three months in ten. The remainder did not reply. The few replies to the question concerning the length of night assignment periods indicate that they are much shorter.

In the children's medical wards, the usual ratio of day nurses to patients is one to three or four. The night ratio is one to fifteen or twenty. The average ward cares for from thirty to forty children. However, these wards vary from sixteen to as high as one hundred patients to a ward. The day period assignments for nurses vary considerably, but in most instances from one to three months, an assignment of three months always being in the three-year training courses. No assignment was for a longer time than three months, and only four or for that period. The day assignment is for less than one month in only six instances. Night assignments also vary considerably, but one for over four weeks in only two instances and usually are for from one to two weeks.

Only five hospitals indicate that they maintain separate surgical wards for infants. Three did not reply. The remainder combine medical and surgical wards. Three hospitals combine infants' and children's surgical wards, and four combine infants' and children's medical. These latter systems may be satisfactory if cubicle and room systems are available, but are certainly not advisable if an open ward is used.

The ratio of nurses to patients on the surgical wards varies from one to two to from one to five during the day and from one to seven to from one to eleven at night.

Fourteen hospitals maintain separate surgical wards for older children. In this group the ratio of nurses to patients during the day varies from one to two to from one to four, during the night, from one to two to from one to thirty six. The last figure indicates inadequate nursing care if there are many acutely ill children on the ward.

The number of patients in the various surgical wards varies from sixteen to sixty. Only two hospitals report wards of more than forty patients and only two have less than twenty.

The day period assignments for the nurses vary from two weeks to four months and the night assignments, from one to four weeks.

Fifteen hospitals maintain separate wards for orthopedic cases. The majority of the other twenty institutions combine orthopedic and surgical cases on the same ward.

Among the hospitals maintaining separate orthopedic wards the ratio of nurses to patients varies from one to three to from one to eight. The night ratio is from one to ten to from one to fifty.

Only ten hospitals maintain separate wards for special cases. Two hospitals have neurologic wards, and the others use special wards for otolaryngologic cases, tonsillectomies, etc.

Seventeen hospitals offer nurses an opportunity for training in the care of contagious diseases. A knowledge of contagious disease nursing is invaluable to any nurse expecting to care for children during her professional career (this type of training should be available in every nursing school).

Operating Room.—Operating rooms in thirty-four hospitals are in charge of experienced graduate nurses. One hospital has no surgical service. Student nurses have operating room duties in only sixteen hospitals. Two did not reply. The

number of operations performed in the respective hospitals during the fiscal year 1932 1933 varies considerably Six hospitals report fewer than 1,000 operations for the year, seven from 1,000 to 2,000 Twelve had over 2,000, 5 over 3,000, 3 over 4,000, and one reported 11,700 operations for the year Ten did not reply

Diet Kitchen—Only one hospital fails to give student nurses instruction and training in the preparation of babies' milk formulas As a rule this training is given to groups of from two to four nurses, and the course of instruction varies from four days to six weeks Over 50 per cent of the hospitals require at least two weeks of work in the formula laboratory, and five require one month there Only nine hospitals limit the length of this course to one week

A fundamental knowledge of infant foods and their preparation is necessary to a nurse expecting to work among infants and children With exceptional teachers this knowledge possibly might be acquired in a one week course, certainly not in a shorter time A two weeks' course is more satisfactory if the instructors are competent

Four hospitals fail to offer nurses training in the preparation of children's diets Eight did not reply Four combine this training with the formula laboratory instruction Again we must emphasize that a sound fundamental knowledge of foods and feeding is essential to the success of any nurse expecting to do efficient children's work A nurse's training course should always include this type of instruction

In only nine instances are student nurses offered practical experience in the social service departments As the majority of the pediatric training schools provide courses for affiliates only, possibly the majority of these nurses have an opportunity to obtain this type of training at some other time in their regular course in the central hospital

Finally, we note that only ten hospitals offer to student nurses a course of training which takes them into all of three very important hospital departments the operating room, diet kitchen and social service

Night Duty—A large proportion of the hospitals require a student nurse to have at least one year of training before she is permitted to do night duty Several do not permit affiliate students on night duty, and eleven institutions require two years of training before night duty is permitted Twelve hospitals permit night duty with less than one year of training This fact appeared to be a discrepancy until it was found that the statement applied to affiliate students and that all of them had had one or two years of training in the central hospital before coming to the children's hospital for pediatric training

Apparently all hospitals are careful that nurses on night duty are experienced, hence better able to meet sudden emergencies which might arise at that time

Supervision—Twenty seven hospitals have graduate nurses in charge of each ward both day and night Four permit student nurses in charge at night Thirty three hospitals have one or more day supervisors and a similar number at night In each instance they are graduate nurses Two hospitals did not reply

In no hospital is a student nurse permitted to have day or night supervisory duties Day supervisors in the various hospitals number from one to sixteen Only three hospitals have more than three night supervisors Thirteen have only one night supervisor, and ten have two

In general the head nurses' and supervisory duties seem to be in competent hands inasmuch as they are, in most instances, handled by graduate nurses, with the exception of the four hospitals in which student nurses are in charge of the wards at night

Miscellaneous—Twenty hospitals offer a course in postgraduate pediatric nursing.

Only nine hospitals offer student nurses an opportunity for training in an affiliated nursing school, and only one affords experience in kindergarten work. Among nurses who intend to make the care of children their life work experience in a nursery school or kindergarten, in which the behavior patterns of normal young children may be observed and learned, we believe to be of a value equal to that of any other part of her training.

Twenty-seven hospitals use 'ward helpers.' These are girls who duties are confined to cleaning care of the linen tray carrying scrubbing floors, and in a few instances they assist in feeding the infants and children.

Instruction of Nurses—Table I reveals in condensed form the nursing courses offered by the respective hospitals.

TABLE I

AFFILIATE COURSE			COMPLETE COURSE (3 YR.)			PART OF 3 YR. OR IL. COURSE		
HOSPITAL	LENGTH OF COURSE	LECTURE AND DEMONSTRATION HOURS	HOSPITAL	LENGTH OF COURSE	LECTURE AND DEMONSTRATION HOURS	HOSPITAL	LENGTH OF COURSE IN MONTHS	LECTURE AND DEMONSTRATION HOURS
1	3 mo	40	2	20 mo	600	8	3	36
2	3 mo	1	3	3 yr	1010	12	3	42
			4	3 yr	812	16	3	60
4	3 mo	1				17	1	40
6	4 mo	158				10	1	36
7	3 mo	36	14	3 yr	982			
8	3 mo	48	19	3 yr	800			
9	G.H.C.		23	2 yr 8 mo	380	9	3 1/2	18 plus
10			29	3 yr	804			
11	3 mo	36	30	3 yr	843			
12	3 mo	42	33	1 yr	260			
13	3 mo	20	34	3 yr	726			
14	3-6-1 mo	1	35	1 yr	406			
15	3 mo	33						
17	1 yr 1	40 1						
18	4 mo	45						
19	3 mo	30						
20	3 mo	15						
21	3 mo	70						
22	3 mo	1						
23	3 mo	28						
24	3 mo	37						
25	3 mo	65						
26	3-4 mo.	40						
27	3 mo	45						
28	4 mo	80						
29	3 mo	1						
31	3 mo	48						
32	3 mo	70						
33	3 mo	24						
34	3 mo	1						
35	6 mo.	1						

School now discontinued.

In summarizing this chart we find that 26 hospitals offer affiliate pediatric nursing courses. Twenty-three courses are for three months; two for four months, and one is a six months course.

Hours devoted to classroom and demonstration instruction in the three-month courses vary from fifteen to seventy nine. The average is about thirty or forty. One four months' course devotes fifty eight hours, the other eighty hours to this type of instruction.

One hospital offers a course in pediatric training only to graduate nurses.

Eleven hospitals offer a three year course of training. The classroom and demonstration hours vary in these respective schools from 209 to 843. Four schools offer over 800 hours of this type of instruction, four, less than 500 hours, and three from 500 to 800 hours.

Special Information—Measures to prevent cross infection such as a separate thermometer, towel, and wash cloth for each infant and child are in general use. Four hospitals do not use separate thermometers for the older children.

Twenty one hospitals require nurses to wear a separate gown in handling each baby and the majority use a cubicle rotation system, together with special gowns, masks, careful scrubbing of hands, and the use of antiseptic solutions. Several institutions require all physicians, nurses, and hospital help to wear masks during the winter months. One requires this precaution only on the infant wards. Several prohibit bedside visiting at all times, and few permit exchange of toys from bed to bed.

Bedside visiting is a problem in all hospitals. Patients probably would have much greater protection if it could always be prohibited.

Dispensary Nursing—Among the thirty four hospitals having dispensaries, thirty have a head nurse in charge of the entire dispensary. One has a supervisory nurse, and three did not reply. Twenty three have supervisory nurses as well as a head nurse. One dispensary has thirteen supervising nurses. Twenty have from one to five.

Fourteen dispensaries employ graduate nurses in addition to the head and supervising nurses. Fifteen do not, and six did not reply. One dispensary employs thirty four graduate nurses. The average number is from one to five. Twenty five dispensaries offer training for student nurses, six do not. One did not reply.

Sixteen offer postgraduate instruction in dispensary work.

Only ten hospitals afford the nurses an opportunity for home visiting, but the majority of the thirty five hospitals have affiliations with the visiting nurse association, the public health service, or the social service for home visiting work, if it is desired.

Only three hospitals indicate that student nurses do not have dispensary duties. Six did not reply. The number of student nurses on duty at any time in the respective dispensaries varies considerably, from one to ten. Eighteen have from three to six. Only five have over six.

In most instances the dispensary service is for a period of from two to four weeks. Of the hospitals having three year courses, five require two months on the dispensary service.

Experience in all departments of the dispensary is given in twenty hospitals. Only 50 per cent of the nurses have it in one hospital, and 33 per cent in another. One does not offer this service to affiliates. Seven did not reply.

Three indicate that nurses are not given experience in all departments of the dispensary.

Nurses do home visiting in only fourteen hospitals. Six did not reply. Usually this is for follow up of a case, rarely for nursing care. The length of time on this service is usually short (from one day to one week). Eleven hospitals

no home visiting during the last fiscal year. Among the remainder, the number of home visits made varied from 6 to as high as 47,000 for the year. Only five report less than 1,000 visits.

CONCLUSIONS

Only eleven hospitals in this country and Canada offer a three-year course in pediatric nursing and the total number of students trained by these schools is not large. It naturally follows that there are comparatively few nurses available in this country who have had comprehensive training in the care of infants and children. Of course, twenty-four children's hospitals offer three months' courses which are available to affiliates from other hospitals and to students of general hospital nursing schools of which the children's hospital may be a unit. However, three months is probably too short a time in which to expect a student to acquire well rounded pediatric training. In view of the fact that so many general hospitals take advantage of the possibility of pediatric training for their nurses in children's hospitals, it is all the more important that these hospitals should demand a course of training adequate to meet the needs. And in view of the fact that so many of the general hospitals have inadequate facilities for caring for children, it seems altogether likely that the number of nurses capable of doing good pediatric nursing must be minimum. In this report it is very interesting to note that only four of the children's hospitals offer pediatric training to graduate nurses. This is certainly a misfortune since there is practically no other place for nurses to obtain graduate work in pediatrics. The training of nursery maids is not so important, but it is surprising that only seven of the hospitals see fit to offer it.

To determine the correct number of hours in a nursing course which should be devoted to classroom and demonstration instruction and thereby set a standard, is difficult. Much depends upon the efficiency of the instructors and the relative intelligence and previous training of the student. Most probably three-month courses should offer at least from twenty-five to thirty hours of that type of instruction. Instruction in nutrition, development and the nature of disease in children preferably should be done by the staff physicians. Eight hundred hours of classroom and demonstration instruction is not too much for a three-year course. (Possibly five hundred hours or less is too little!)

The proportionate number of nurses assigned to day and night duty on wards varies considerably with the respective hospitals. In most instances there seems to be an adequate number of nurses for efficient care of the patients particularly during the day. In a few instances there may be some question whether there are a sufficient number of night nurses employed. Night assignments are usually and should be for a comparatively short period.

In general the number of patients on any one ward is not large. We note only two hospitals report wards having more than 40 patients.

Less than one-half of the hospitals maintain separate wards for orthopedic cases and one-third have separate wards for special cases, such as neurologic, otolaryngologic (tonsillectomies) etc.

Only one-half of the hospitals offer contagious disease training for nurses but in many instances this training is available only by affiliation or special courses in contagious disease hospitals in the same city.

The operating rooms of the various hospitals are all in charge of graduate nurses. How efficient they may be, the questionnaire cannot tell us. However, eighteen hospitals afford no operating room duty to student nurses. This fact, of

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Comments

FOR many years the work of the National Board of Examiners has been of interest and importance to every one involved in the field of medical education. In 1933 over 500 graduates took the final (Part III) examination for a certificate, or approximately one-tenth of the total applicants for licensure in the United States in that year. Every one has the highest respect for the purposes and character of the Board and its methods of work. It is difficult, however, to understand the attitude of the Board toward the subject of pediatrics, unless it is perhaps that the Board has been so involved in the technic of the work that it has failed to keep pace with and grasp some of the significant changes and trends in medical education and practice of recent years.

The position and place of pediatrics in undergraduate medical education has been steadily changing during the years the National Board of Medical Examiners has been in existence. While twenty years ago it was as a whole a subdepartment of medicine the position of pediatrics has changed until medical educators today regard it as one of the four basic branches of clinical medicine and in over 90 per cent of our medical schools independent departments have been organized of equal academic rank and importance in those of medicine, surgery and obstetrics. The National Board of Medical Examiners has failed to take cognizance of this change and development and still dismisses pediatrics with a couple of questions included in the examination in medicine. It was only three years ago, after considerable pressure, that a pediatrician was added to the Board who could give some advice as to the character and scope of these questions.

It is difficult to grasp the logic of the reasoning of the Board which considers pediatrics as a specialty. First of all this is quite contrary to the situation which exists in our medical schools. Despite the fact that those most deeply concerned in medical education regard it and give it the position of a basic subject, the Board arbitrarily takes the stand that it is a specialty.

It has been said that the examination of the newly formed American Board of Pediatrics takes care of the matter of a special examination for pediatrics. This is loose and incorrect thinking. The examination of the National Board of Medical Examiners covers undergraduate medical instruction. Its purpose is to ascertain if the general basic medical training is sound and qualifies the individual to enter into the general practice of medicine. The examination of the Board of Pediatrics is to ascertain if the individual has sufficient specialized training and specialized knowledge to practice pediatrics as a specialist. If the National Board of Examiners is consistent in this attitude we do not see how they can continue to hold a separate examination in obstetrics, as exactly the same situation exists here as in the case of pediatrics. A moment's thought as regards another of the basic clinical subjects, surgery shows this viewpoint to be illogical. The National Board of Examiners holds a separate examination in surgery. Does it mean that they believe a fourth year medical student who passes this examination is qualified to go out and perform major operations? This we are sure is further from their thoughts. The scope of this examination covers the basic principles of surgery and not surgery as a special

ized therapeutic technic. This is what is needed for pediatrics, not a "specialist" examination, but an examination which covers pediatrics as taught in the medical school as one of the four basic clinical subjects of instruction.

We feel that the attitude of the National Board of Medical Examiners lies chiefly in its failure to keep abreast of the changes and trends in medical thought and in undergraduate medical education. The situation should be remedied and a separate examination in pediatrics should be instituted by the National Board of Medical Examiners.

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Announcing Irradiated Pet Milk

"Whatever the explanation may be, the fact remains that the incidence of rickets is still too great and will continue to be until some cheap, generally available, agreeable source of vitamin D is provided. Vitamin D milk seems to offer promising possibilities of meeting these requirements."

EDITORIAL, The Journal of the American Medical Association November 25 1933.

Before giving you, on this and subsequent pages, a description of the process by which Pet Milk is enriched with vitamin D, let us note briefly the respects in which Pet Milk meets the above named requirements

1 Cheapness and Availability The tall can of Pet Milk, equal to nearly a quart of ordinary milk, can be bought anywhere for no more than 8 cents—generally for not more than 7 cents. Every grocer in America has, or can readily get, Pet Milk. The cost of it to the public is not increased by the irradiation.

2 Agreeability Babies as readily take Pet Milk as any other milk, either from birth or at weaning time. Children can be brought to drink it readily. We

have hundreds of recipes which are designed to put more milk in cooked and prepared foods through the use of double rich Pet Milk—making as delicious food as can be made with any form of milk. Children and adults who do not readily drink milk can be given their quota in agreeable form in the food they eat.

THE Wisconsin Alumni Research Foundation, a non-profit corporation, is the owner of the Steenbock patents on the process of enriching food with Vitamin D (the sunshine vitamin) by irradiation with ultra violet rays. Pet Milk Company is licensed to use the irradiation process under these patents. The income from the royalties on these patents is used for the promotion of scientific experiment and investigation. The royalties are small—so small that it has not been necessary to increase the price of Pet Milk on account of the royalties paid. All Pet Milk is irradiated. The increased Vitamin D potency is most beneficial to the many who need it.

The Process of Enrichment with Vitamin D

Pet Milk is enriched with vitamin D by direct irradiation of the concentrated milk with ultra-violet rays under the Steenbock patents by license from Wis-

consin Alumni Research Foundation, the owner of the patents

With Approved Equipment

The equipment used in the irradiation

of Pet Milk is approved by Wisconsin Alumni Research Foundation Figure 1 is a picture of the complete irradiating machine Figure 2 represents the machine with a cut-out of one side showing the location of the lamp in the center of the cylinder The milk in a thin film flows down the inside of the cylinder on the slightly sloping sides, exposed to the ultra-violet rays which create the vitamin D in the milk

The Regular Flow of the Milk

To secure uniformity of potency in the irradiated milk, the flow of the milk must, of course, be uniform This flow

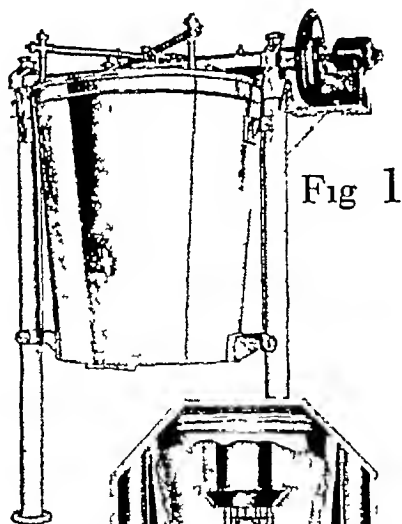
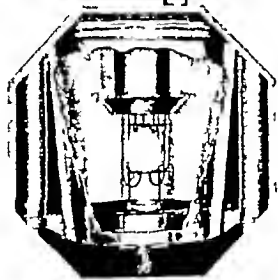


Fig 1

Fig 2



in a uniformly thin film is accomplished by the device of an accurately adjusted pump which throws the milk into a circular trough at the top of the cylinder from which the milk flows by gravity through small openings in the bottom of the trough down the side of the irradiating chamber

The Regularity of the Rays

The uniformity of the potency of the vitamin D in the milk depends upon the constancy of the rays as well as upon the regularity of the flow of the milk The ultra-violet rays are created by a carbon arc lamp which hangs in the center of the cylinder (figure 1) Figure 3 is a picture of the lamp The constancy of the rays depends upon the constancy of the electric current, which is accurately controlled, and upon the distance between the carbon points This feature of the lamp is nicely adjusted by an automatic motor located at the top of the lamp This motor keeps the carbon points accurately adjusted at just the right distance from each other Figure 4 is a picture of the automatic lamp control and recording device, with indicator showing the flow of current

Results Accurately Recorded

Recording instruments make a record of the operation of the irradiator during all the time it is in operation Any variation either in the flow of the milk or of the electric current is recorded on the disc which shows each day's operations Figure 5 is a picture of a disc on which one day's operation is recorded

Its Place in the Process

Pet Milk is, as you know, concentrated to double-richness by removing about sixty per cent of the water from the natural milk by evaporation in a partial vacuum (about 26 inches) at a temperature of about 125° F The concentrated milk goes directly from the vacuum pan to the irradiator The flow of the milk in the irradiator is so adjusted as to take it as fast as it comes from the vacuum pan (6,000 pounds per hour) The amperage of the electric current is so adjusted as to give to the milk flowing at this rate the desired vitamin D potency

Why Irradiated after Concentration

In the early experiments in irradiation, it was believed that the milk could not be irradiated to the desired potency

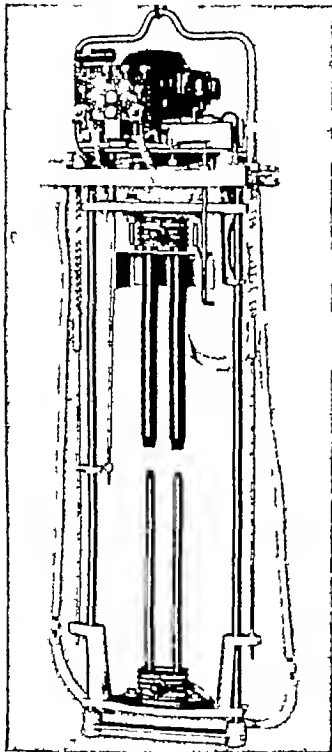


Fig 3

after it was concentrated. By extensive experiments in our plants, it was discovered that it could be so irradiated, thus doubling the capacity of the machine without reducing the potency of vitamin D in the milk. Only in this re-

spect—irradiation after concentration—does the irradiation of Pet Milk differ from the irradiation of bottle milk.

The Potency of Irradiated Pet Milk

The irradiating equipment in Pet Milk plants is so adjusted in milk flow and in amperage of electric current as to give to the irradiated milk a vitamin D content of not less than 50 Steenbock units to the tall can (14½ oz.) This is the unit potency usually given by direct irradiation to a quart of bottle milk.

The Anti rachitic Potency

Extensive feeding experiments with rats conducted in our laboratories indicate that the anti rachitic potency of Pet Milk is equal in all respects to the potency of irradiated unconcentrated milk. Clinical experiments are now being conducted. We have every reason to believe that the normal daily supply of Pet Milk will afford a reliable, preventive quantity of vitamin D for the normal child.

Not Offered as a Cure

We do not offer irradiated Pet Milk as a cure for rickets. We do believe that it will prove to be a reliable preventive for the normal child. We are not, of course, advising mothers to forego the use of other preventives. On the contrary, we are urging their use whenever they are prescribed by a physician. We furnish no formulas to the laity for preparations of feedings of Pet Milk. Our advertising to the laity, in so far as it deals with infant feeding, is intended only to



make Pet Milk readily acceptable to mothers when physicians prescribe it for their babies

No Possibility of Harm

We irradiate all Pet Milk and urge its use for all purposes, believing that it may be of distinct benefit to all who use it. We accept the verdict of the most prominent authorities that the use of vitamin D in several times the quantities needed for the prevention of rickets cannot possibly be harmful to anyone.

Flavor and Character of the Milk Not Changed

No detectable change is made in the flavor of Pet Milk by

the irradiation. There is no change in the character of the milk except the enrichment in vitamin D. In our feeding experiments we have definitely demonstrated that no appreciable change in the vitamin A potency of the milk results from the irradiation.

The Standard Qualities of Pet Milk

Irradiated Pet Milk retains all the definitely established qualities which have heretofore made it such a satisfactory milk for infants. Every drop of Pet Milk is always uniformly rich in all the milk-food substances. It is completely sterile, surely free from living organisms — as safe as if there were no germ of disease in the

world. It is more easily digested by infants than is ordinary milk — the curds are soft and flocculent as those from mother's milk — the fat quickly and easily digested.

*We Furnish No
Formulas to the Laity*

Fig
4

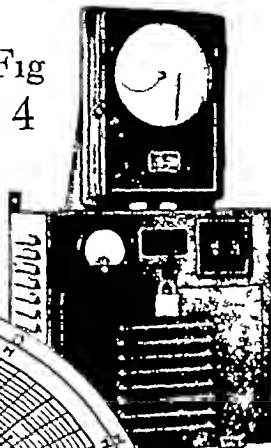
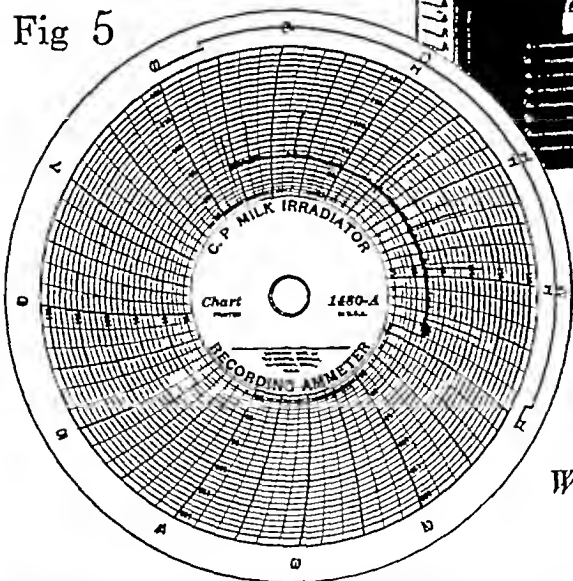


Fig 5



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☐ New Book for physicians ☐ Irradiated Pet Milk—Its Character
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City _____ State _____

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DIARRRHEA

"the commonest ailment of infants in the summer months"

(HOLT AND McINTOSH: HOLT'S DISEASES OF INFANCY AND CHILDHOOD 1933)

One of the outstanding features of DEXTRI-MALTOSE is that it is almost unanimously preferred as the carbohydrate in the management of infantile diarrhea.

In cases of malnutrition and indigestion in infancy, dextrin maltose improves rapidly and the stools soon become normal in appearance. The sugars are intelligently prescribed. By this I refer to proper proportions of dextrin and maltose. When there is a tendency to looseness I have used the preparation known as **dextrin maltose** for carbohydrates. —M. Ladd Further experience with dextrin maltose. Arch. Pediat. 33 601-612 July 1916

Dextrin maltose is a very excellent carbohydrate. It is made up of maltose a disaccharide which in turn is broken up into two molecules of glucose—a sugar that is not as readily fermentable as levulose and galactose—and dextrin a partially hydrolyzed starch. Because of the dextrin there is less fermentation and we can therefore give larger amounts of this carbohydrate without fear of any tendency of fermentative diarrhea. —A. Copper Facts and fads in infant feeding. N. Y. J. Child Dis. 1 278 283

In cases of diarrhea For the first day or so no sugar should be added to the milk. If the bowel movements improve carbohydrates may be added. This should be the one that is most easily assimilated so **dextrin maltose** is the carbohydrate of choice. —W. H. McCaslin Summer diarrhea in infants and young children. Pediatrics 1 278 283

If there is an improvement in the teaching of the originator the carbohydrate added should be the one that is most easily assimilated. **Dextrin maltose** is there for the carbohydrate of choice. —Summer diarrhea in the young. International J. 9 111 118

The condition in which **dextrin maltose** is particularly indicated is in acute attacks of vomiting, diarrhea and fever. Recovery is more rapid and recurrence less likely to take place if **dextrin maltose** is substituted for milk sugar or cane sugar when these have been used and the subsequent gain in weight is more rapid. In brief I think it safe to say that pediatricians are relying less implicitly on milk sugar but are inclined to split the sugar element giving cane sugar a place of value and **dextrin maltose** a decided prominent place particularly in acute and difficult cases. —W. L. Hoskins Present tendencies in infant feeding. Indianapolis M. J. 1914

Gradual transition to a whole milk or evaporated milk formula which will supply about one and one half to two ounces of whole milk to every pound of body weight is reached. This also should finally have the addition of **dextrin maltose** amounting to five to seven per cent. —R. A. Strong Summer diarrheas in infancy and early childhood. Arch. Pediat. 33 233 236 April 1916

SERIOUSNESS OF DIARRRHEA

There is a widespread opinion that, thanks to improved sanitation infantile diarrhea is no longer of serious aspect. But Holt and McIntosh declare that diarrhea "is still a problem of the foremost importance, producing a number of deaths each year. Because dehydration is so often an insidious development even in mild cases, prompt and effective treatment is vital. Little states (Canad. Med. A. J. 13 803 1923) "There are cases on record where death has taken place within 24 hours of the time of onset of the first symptoms."

In the treatment of diarrhea The sugar is added gradually as conditions admit some sugar other than milk sugar or cane sugar being used preferably **dextrin** and **maltose**. —H. E. Small Diarrhoea in bottle fed infants. Maine M. A. 12 164 168 Jan 1922

It should be noted that a percentage of lactose may cause diarrhoea. If a milk containing a percentage of sugar be required it is better to replace it by **dextrin maltose**, such as Mead's Nos. 1 and 2 where the maltose is only slightly in excess of the dextrin, thus diminishing the possibility of excessive fermentation. —W. J. Pearson Common practices in infant feeding Post-Graduate Med. J. 6 38 1930 abstr. Brit. J. Child Dis. 28 162 163 April June 1931

Just as DEXTRI-MALTOSE is a carbohydrate modifier of choice, so is CASEIN (calcium caseinate) an accepted protein modifier. Casein is of special value during the summer months (1) for colic and loose, green stools in breast-fed infants; (2) in fermentative diarrhea in bottle-fed infants; (3) as a prophylactic against diarrhea in infections.

When requesting samples of Dextrin Maltose please enclose professional card to cooperate in preventing their reaching unauthorized persons. Mead Johnson & Company Evansville Indiana U. S. A.

The Journal of Pediatrics

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Clinical Background of Dextri-Maltose

Continued down from 1911

1922

In the treatment of diarrhea The sugar is added gradually as conditions admit some sugar other than milk sugar or cane sugar being used, preferably dextrin and maltose. —H E Small *Diarrhoea in bottle fed infants*, J Moine M A 12 104-108 Jan 1922

1922

The use of other soluble carbohydrates other than lactose for milk modifications are very good. Some believe the addition of dextrose or dextri maltose makes the casein curd softer and easier to digest. This is questioned, but all agree that in cases of malnutrition where the patient is intolerant to lactose and cannot get the benefit needed from the fat in the diet that the dextri maltose is invaluable as it is the easiest sugar to digest, and can be immediately used for energy production without undergoing further change —E G Padfield, *Remarks on infant feeding* J Kansas M S 28 97 101 April 1922

1922

In the treatment of intestinal disturbances Practically the method followed has been that employed when beginning simple dilutions starting with $\frac{1}{4}$ or $\frac{1}{2}$ albumin milk, diluting with water and sweetening with saccharin, except that the food has been strengthened more rapidly Dextri maltose No 1 is added as soon as possible to reinforce the food value as albumin milk alone in full strength values but 13 Calories per ounce —S D Giffen, *The feeding of infants based on recent experience* Ohio St M J 18 829-833 Dec. 1922

1922

maltose is usually better tolerated by babies than either lactose or dextrose. Advantage may be taken of this property of maltose by developing as rapidly as possible the starch-digesting functions of infants with low degrees of sugar tolerance since the slow conversion of starch into maltose by the action of diastase promotes the object in view most satisfactorily —L. Pritchard, *The Physiological Feeding of Infants and Children* Henry Kimpton London 1922 p 305

1922

A large percentage of the sugars ingested with the food is lost through fermentation Lactose is most readily affected by the intestinal bacteria, undergoing lactic acid fermentation which gives the stool of the breast fed infant its characteristic sour odor. In bottle-fed infants this fermentation is likely to exceed the limits which occur in natural feeding and an acid diarrhea frequently results from the fermentation of the lactose. If the fermentation is not promptly controlled serious disturbances may result. Maltose does not ferment as readily as lactose while cane-sugar does not undergo lactic acid fermentation at all. Dextrin and starch exert an inhibiting action over intestinal fermentation and are therefore used to correct this tendency in the bottle fed infant —C S Rowe, *Diseases of Children* Boericke & Tafel Philo 1922 p 54.

1922

In the treatment of marasmus ten $\frac{1}{2}$ oz feeds of albumin milk with 3 per cent carbohydrate altogether made up with dextri maltose are administered in the twenty four hours at intervals of two hours also as much water as the child wants in between feeds. If the weight has been steadily increasing the dextri maltose is then gradually and cautiously increased to 5 per cent., and after a week or two (or four to five weeks on albumin milk altogether) a return can be cautiously made to a suitable ordinary milk mixture if all be well —B Myers, *Practical Handbook on the Diseases of Children* H K Lewis & Co London 1922 p 160

1922

Maltose, either in the form of malt soups or in combination with dextrin dextrimaltose, can be substituted for milk-sugar

It is very much more easily assimilated than other sugars. It will however break down more readily. It should be weighed in determining the proper amount to add. —R. S. McCombs, *Diseases of Children for Nurses* W B Saunders Co Phila. 1922, p 405

1922

If there is any tendency to sugar fermentation use a preparation with a high dextrin and relatively low maltose content as Mead's dextri maltose.

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In marasmus When the stools have become smooth and saline like, carbohydrate, in the form of dextri maltose may be gradually added up to the limit of tolerance. —L. W. Hill, *Practical Infant Feeding* W B Saunders Co Phila. 1922, pp 206 231

1922

In the treatment of decomposition As a rule it is best to start with 2 to 2 $\frac{1}{4}$ or 3 ounces of albumin milk to the pound weight in 24 hours the sugar to be added is in the form of a maltose-dextrin mixture One should never delay too long in adding this —C G Grulee, *Infant Feeding* W B Saunders Co Phila., 1922 p 205

1922

In decomposition The period of repair may be shortened by giving suitable additional food, the best probably being buttermilk to which carefully regulated proportions of dextrin and maltose preparations or malt soup are added —L. Feer, *Text-Book of Pediatrics* J B Lippincott Co Philo 1922 p 234

1922

Regarding treatment of the marantic infant After the intolerance to sugar has been overcome a carbohydrate preferably Dextri maltose may be added. —C S Rowe, *Diseases of Children* Boericke & Tafel Philo 1922 p 427

1922

In spasmodic Dextrin maltose is the best sugar to use in these cases in the proportion of 6 to 8 per cent —J H Reading Jr., *Spasmodic Hahnemann Monthly* pp 403 411 July 1922

1922

In pylorospasm Before the food is given the stomach is carefully washed until the washings return clear. The food is then given through the tube before it is with drawn The food given in these instances is practically always a mixture of albumin milk and a dextrin maltose combination, a quantity sufficient to meet the needs of a child of like age and weight without gastro-intestinal disturbance —C G Grulee, *Treatment of Pylorospasm in Infants* J. A. M. A 78 1153 1154 April 22, 1922

1922

Malt sugars are of value and are better than milk sugar in increasing nutrition and adding weight. —W L Carr, *A group of difficult feeding cases* Arch. Pediat 39 716-719 Nov 1922

Continued down to 1934

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—QUILLIAN, WARREN J Florida Med Assoc, Jan, 1934

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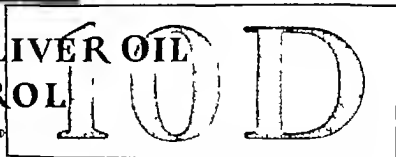
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Williams McKim Marriott, *Infant Nutrition* 151 (1930)

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Julius H. Hess, *Feeding and the Nutritional Disorders in Infancy and Childhood* 7 (1930)

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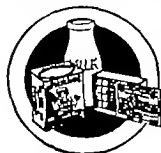
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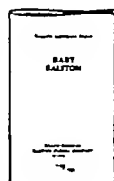
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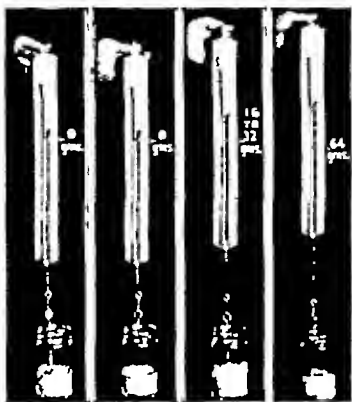
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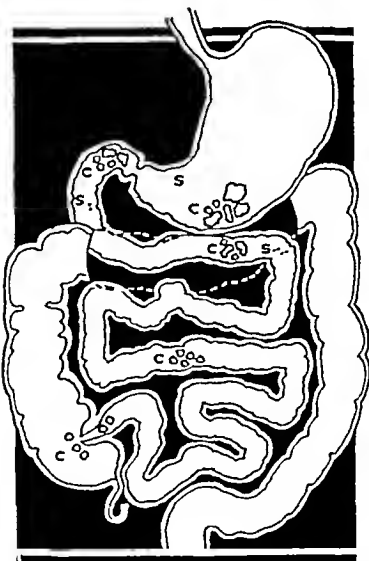
CURD TENSION

- AND INFANT FEEDING -

ITS • EFFECT • UPON • THE • ASSIMILATION • OF
PROTEINS



BREAST MILK SIMILAC POWDERED MILK COW'S MILK



C—Cow's milk S—Similac
Schematic drawing of the relative size of the curds of cow's milk and Similac vomited by six weeks old puppies after one half hour's ingestion

"THE most available and the most easily digestible form of protein for infants is the protein of milk. The protein of breast milk is more digestible than that of cow's milk."

"In the light of our present knowledge, the chief cause of the difference in the digestibility of the protein of human milk and that of cow's milk lies in the greater proportion of casein in cow's milk."

"It is the formation of large curds which renders the casein of cow's milk so much more difficult of digestion by the infant than that of human milk. If the formation of large casein curds in the stomach can be prevented, the casein of cow's milk is easily digested."

In SIMILAC the large casein curds are not formed. The curds formed when the gastric enzymes act upon SIMILAC are small and flocculent, registering zero on the tensiometer, as shown in the illustration, hence more easily digested.

The finer the curd the greater the surface area. The greater the surface area the more exposed are the fats, carbohydrates, proteins and salts to the digestive enzymes. Result—a more complete utilization of the food elements.

*Morse and Talbott, Diseases of Nutrition and Infant Feeding, pgs 214, 215

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SIMILAC—Made from fresh skim milk (casein modified) with added lactose salts, milk fat and vegetable and cod liver oils.

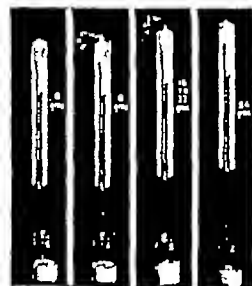


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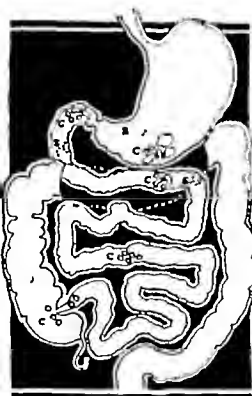
CURD TENSION

- AND INFANT FEEDING -

ITS EFFECT UPON THE ASSIMILATION OF
SALTS



BREAST MILK SIMILAC POWDERED MILK COW'S MILK



C—Cow milk S—Similac
Before the drawing of the relett, the curds of cow's milk and Similac were fed by 14 weeks old puppies after one-half hour ingestion.

THE mineral salts play a very complicated part in digestion because they are not only absorbed by the intestines but also may be re-excreted into the digestive canal."

"The mineral salts are of even greater importance in infancy than in later life because of the rapid growth of the bony structure. The salts are also necessary for cell growth and are important constituents of the blood and digestive juices, facilitating secretion, absorption and excretion."

Some of the important mineral salts are encased within the large tough curds formed from cow's milk, and only those salts that are not encased in the curds are available for metabolism.

The curds formed from SIMILAC are small and flocculent, registering zero on the tensiometer as shown in illustration, hence the mineral salts of SIMILAC are available for metabolism.

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Moore and Talbot: Diseases of Nutrition and Infant Feeding, pg. 59
Merrill: Infant Nutrition, pg. 43

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milk fat and vegetable and cod liver oils.



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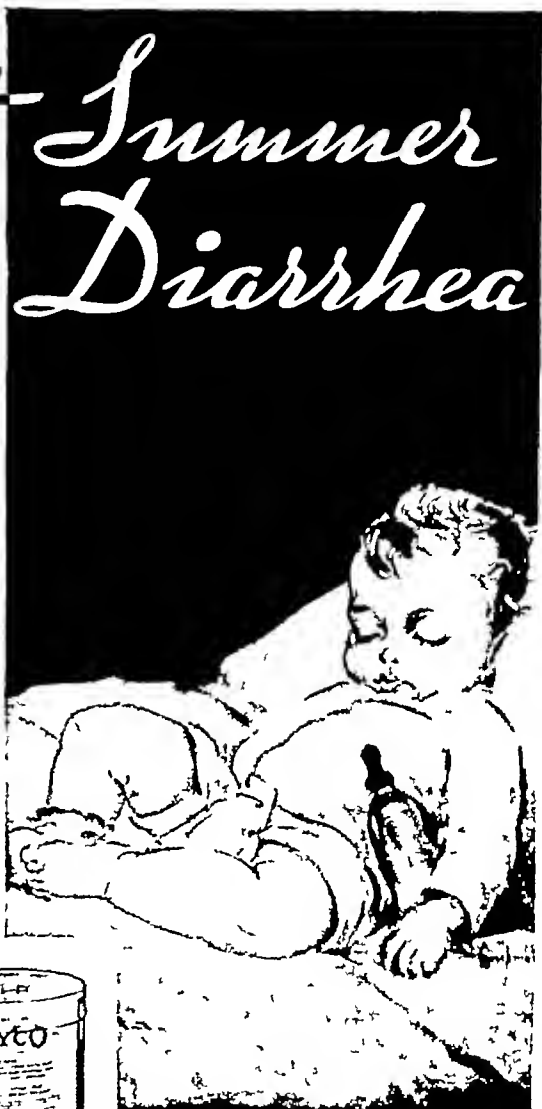
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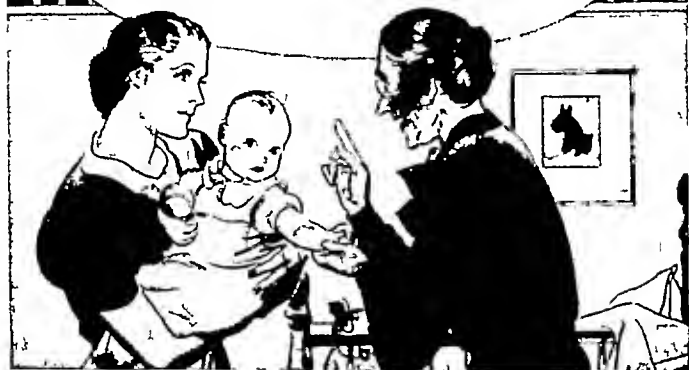
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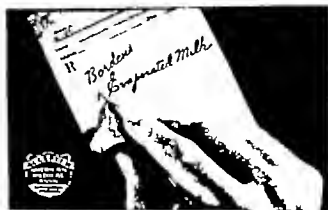
Perhaps your formula calls for evaporated milk Which evaporated milk doctor? The brand you specify is the brand that will be used. Your standards, naturally are high and you know that only certain brands of evaporated milk reach those standards.

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Fig. 1 First Steps (1 termid t. Soles)

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Five essential points in the making and fitting of a baby shoe are shown in this illustration of Ideal Baby Shoe No. 381 Last 44. Length, width of toe, depth of toe, depth of instep and gripper. A heel must always be present if the shoe is to give comfort and prepare the foot properly for its long walk through life.

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The medical profession has long used and recommended cod liver oil. More than 50 years ago The Maltine Company realizing the therapeutic value of cod liver oil studied the possibility of incorporating this oil in a concentrated malt extract, hoping thereby to increase the palatability of the oil and to make available to the medical profession an emulsion which would combine the virtues of the two valuable components—MALTINE WITH COD LIVER OIL was the result.

It was found that the new MALTINE WITH COD LIVER OIL was palatable and easily tolerated by children and adults, many of whom had previously found it difficult to take plain cod liver oil. More recently tests of various kinds including biological and clinical have shown that MALTINE WITH COD LIVER OIL has other characteristics besides palatability to recommend it.

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See E. R. Grover, H. F. and Qui, E. J. "A Method of Evaluating the Vitamin A Value of Cod Liver Oil" Proc. Soc. for Exper. Biol. and Med., January 1933, p. 516.

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This book covers the definition of migraine and historic consideration, the hereditary factor, incidence, etiology, symptomatology, pathology, laboratory data and prognosis, treatment of nonallergic and allergic migraine, the localization and specificity of cellular sensitization, clinical records in proven cases of allergic headache illustrating methods of diagnosis of migraine from other allergic headache and treatment.

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Useless for parents to force children to eat

if lack of Vitamin B
is the cause of their poor
appetite!

With many children, lack of appetite goes hand in hand with other symptoms. They seem perverse, hard to manage. And back of all this trouble, very often, is one cause—*not enough Vitamin B!*

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One of the most effective ways of adding Vitamin B to the child's diet is with a delicious food drink! *Squibb's Chocolate Flavored Vitavose!*

A glass of milk to which three heaping teaspoonfuls of Chocolate Vitavose have been added gives children the equivalent of a whole quart of milk in the important Vitamin B value.

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also helps these children put on weight! When their appetite increases they build up quickly.

And children enjoy drinking Chocolate Vitavose. They like it with their meals or after school. Have mothers give it to them every day.

The next time you have a case of poor appetite, try this new approach through the child's diet. Recommend *Squibb's Chocolate Flavored Vitavose!*

Babies who eat poorly may not be getting enough Vitamin B. Either of Squibb's milk modifiers for infants—Squibb Vitavose or Dextro-Vitavose—will enrich the baby's diet in Vitamin B. Prescribe them as a routine for the baby with poor appetite.

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DIARRRHEA

"the commonest ailment of infants in the summer months"

(HOLT and McINTOSH: HOLT'S DISEASES OF INFANCY AND CHILDHOOD 1933)

One of the outstanding features of DEXTRI-MALTOSE is that it is almost unanimously preferred as the carbohydrate in the management of infantile diarrhea.

In cases of malnutrition and indigestion in infancy the stools soon become normal in appearance and the sugars are intelligently prescribed. By this I refer to proper proportions of dextrin and maltose. When there is a tendency to looseness, I have used the preparation known as **dextrin maltose**, for carbohydrates. —M. Ladd Further experience with carbohydrates. Arch Pediatr 33 601-612 July 1916

Dextrin maltose is a very excellent carbohydrate. It is made up of maltose a disaccharide which in turn is broken up into two molecules of glucose—a sugar that is not as readily fermentable as levulose and galactose—and dextrin a partially hydrolyzed starch. Because of the dextrin there is less fermentation and we can therefore give larger amounts of this carbohydrate without fear of any tendency of fermentative diarrhea. —A. Copper Facts and fads in infant feeding. U. S. A. J. 13 803 1923

In cases of diarrhea. For the first day or so no sugar should be added to the milk. If the bowel movements improve carbohydrates may be added. This should be the one that is most easily assimilated so **dextrin maltose** is the carbohydrate of choice. —W. H. McCaslin Summer diarrhea in infants and young children. Alabama. 1,278 258

If there is an improvement in the teaching of the originator the carbohydrate added should be **dextrin maltose** is there for the carbohydrate of choice. —Summer diarrhea in the young. International J. 9 111 118

The condition in which **dextrin maltose** is particularly indicated is in acute attacks of vomiting, diarrhea and fever. It seems that recovery is more rapid and recurrence less likely to take place if **dextrin maltose** is substituted for milk sugar or cane sugar when these have been used and the subsequent gain in weight is more rapid. In brief I think it safe to say that pediatricians are relying less implicitly on milk sugar but are inclined to split the sugar element giving cane sugar a place of value and **dextrin maltose** a decidedly prominent place particularly in acute and difficult cases. —W. J. Hoskins Present tendencies in infant feeding Indianapolis M. J. July 1914

evaporated milk formula to a whole milk or one and one half to two ounces of whole milk to every pound of body weight is reached. This also should finally have the addition of **dextrin maltose** amounting to five to seven per cent. —R. A. Strong Summer diarrhea in infancy and early childhood. Arch Pediatr 33 233 236 April, 1921

SERIOUSNESS OF DIARRRHEA

There is a widespread opinion that, thanks to improved sanitation in infantile diarrhea is no longer of serious aspect. But Holt and McIntosh declare that diarrhea "is still a problem of the foremost importance producing a number of deaths each year. Because dehydration is so often an insidious development even in mild cases prompt and effective treatment is vital. Little states (Canad Med A J 13 803 1923) 'There are cases on record where death has taken place within 24 hours of the time of onset of the first symptoms'.

In diarrhea **dextrin maltose**, well cooked cereals or rice usually can be handled without trouble. —B. B. Jones A discussion of some of the common infantile diarrhea and the diets used in the treatment. Arch Pediatr 33 601-612 July 1916

Maltose is more easily absorbed than cane or milk sugar by changing the carbohydrate may prevent a deficient supply of sugar. When sugar causes diarrhea one can change the form of it. Mead's **Dextrin maltose** in small doses is more quickly absorbed and so superior to cane and sugar. Lactose is expensive and seems not to be better than cane sugar. —H. B. Gladstone Infant Feeding and Nutrition William Heinemann Ltd London 1928 pp 11 70

bowel and have a definite laxative tendency which may when carried to excess cause severe intestinal irritation. The more complex carbohydrates of which dextrin is the type ferment more gradually and do not have this laxative effect.

Regarding the treatment of diarrhea. In our experience the most satisfactory carbohydrate for routine use is Mead's **dextrin maltose** No 1. —F. R. Taylor Summer Complaints Southern Med & Surg. pp. 666-669, Aug.

In the treatment of diarrhea, the sugar is added gradually as compared with some sugar other than milk sugar or cane sugar being used preferably **dextrin** and maltose. —H. E. Small Diarrhoea in bottle fed infants J. Maine M. A 12 164 168 Jan 1922

It should be noted that a large percentage of lactose may cause diarrhea. It is a matter of degree as to how much lactose is required it is better to replace it by **dextrin maltose**, such as Mead's Nos. 1 and 2 where the maltose is only slightly in excess of the dextrins, thus diminishing the possibility of excessive fermentation. —W. J. Pearson Common practice in infant feeding Post-Graduate Med J. 6 38 1930 abstr Brit J Child Dis 28 162-165 April June 1931

that group of organisms thrive on) and high in protein. (the food which) is necessary to use the casein calcium for from 5-8 days we found DeSanctis and L. V. Pader The value of calcium caseinate milk in fermentative diarrhea Arch Pediatr 33 233 236 April, 1921

Just as DEXTRI-MALTOSE is a carbohydrate modifier of choice, so is CASEC (calcium caseinate) an accepted protein modifier. Casec is of special value during the summer months (1) for colic and loose green stools in breast-fed infants (2) in fermentative diarrhea in bottle-fed infants; (3) as a prophylactic against diarrhea in infections

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MAY 1934

No. 5

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THE THYMUS GLAND AND THYMIC SYMPTOMS

AN INVESTIGATION OF 1,074 NEWBORN BABIES

AARON CAPTER, M.D. AND ROBERT A. SCHLESS, M.D.
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THE thymus gland and its relationship to a certain more or less definite symptom complex in the newborn and babies in early infancy presents a number of problems for consideration and study. This question has been discussed from various angles by many observers in different countries particularly in the United States. Opinions are quite divergent. One cause for this difference of thought is the confusion that has arisen because of attempts to link so-called simple hypertrophy of the thymus itself with the constitutional diathesis status thymicolymphaticus. Furthermore the causation of the occasional sudden death that occurs in infancy and early childhood for which no clinical or anatomical basis can be found is traditionally associated with the thymus and termed 'thymic death'. Marine¹ in reviewing the status lymphaticus problem says that he accepts the views expressed by Friedleben, Paltauf, Wiesel, Hart, Ohlmaecher, Thomas and others, that there is no known disease entity in which the thymus occupies the central or causal role. He says that the terms, 'thymic death', 'thymic asthma,' 'status thymicus' and 'status thymicolymphaticus,' are misleading. Other writers correlate 'thymic death' with status thymicolymphaticus. We feel that the thymus syndrome which occurs in newborn infants and with which we are concerned in this present investigation bears no relationship to the status thymicolymphaticus syndrome. The latter is a systemic disease affecting not only the thymus gland but also the spleen, intestinal follicles, lymph nodes, tonsils, Waldeyer's ring, Peyer's patches, and bone marrow, and it is associated with hypoplasia of the cardiovascular system and probably of the chromaffin system and gonadal glands (suprarenal cortex, interstitial cells of the testes and ovaries). When such an individual

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grows older, a distinctive body constitution is usually also associated therewith. The infants that have an enlarged thymus gland do not, however, belong to any particular constitutional type, except that a number of observers claim that the large well-nourished baby is more prone to suffer from hypertrophy of the thymus. Cole² doubts the diagnosis of "thymic death" and considers the diagnosis of enlarged thymus an "alibi diagnosis", he states that there is little evidence to show that the thymus plays any pathologic rôle. "Certainly it is so rare," he says, "as to be practically negligible in its importance in pediatric practice." Hammar,³ as a result of an investigation of a series of so-called "thymic deaths" in children, found no marked enlargement of the gland, no definitely characteristic pathologic or morphologic changes, nor any basis for assuming that death was due to an increased or decreased function of the gland.

The weight and size of the thymus are subject to great fluctuations, and for this reason it is very difficult to set up an average weight or even to state a limit beyond which the gland becomes pathologic. In other words, the size and weight of the thymus gland vary so much within normal limits that it is only when an extremely large gland is found at autopsy that the condition can be called abnormal. It certainly appears that the size and weight of the thymus gland are closely related to the general state of nutrition of the infant, and that with a loss of weight there is a corresponding loss of gland-substance in the thymus, nevertheless, we cannot speak of an exact relationship between size of the thymus, age, body weight, or state of nutrition. In this connection, the thought projects itself as to whether the frequently made observation that hypertrophy of the thymus is usually found in the large infant is not due to the fact that a well-nourished, large infant would proportionately have a greater amount of thymic tissue. This physiologically large thymus might in turn be diagnosed as the cause of any symptoms related to the so-called "thymus syndrome." According to Finkelstein,⁴ an anatomical diagnosis of hypertrophy of the thymus should only be made when, in the presence of good nutrition, the weight of the gland is above 20 gm in the first year and above 25 gm in the second year. Marine¹ states that "anatomists in general agree that the absolute weight of the thymus gland increases rapidly up to the end of the second year of life, and then changes but little until the seventh year, when it again increases slightly, to fall off again at about the eleventh year." Hammar⁵ found the increase in the size of the gland after the second year largely due to an increase in the interlobular stroma.

There is a great variation in observations as to the supposed normal weight of the thymus gland at different ages. This is due to the fact that most terminal illnesses that last over twenty-four hours cause a reduction of the weight of the thymus, the gland of a two-week-old

infant who has been sick for a week will be smaller than the gland of a similar sized and aged infant who has been sick for only one day before death. In other words, this shrinkage of the thymus is probably a part of the general involution resulting from disease and inanition. The correct weight of the thymus gland is best obtained where the individual died an accidental death, with no preceding illness. Boyd⁸ says "with the exception of tumors of the thymus, leucemia, and exophthalmic goiter, the weight of the thymus is reduced from whatever illness has caused death, when said illness has lasted twenty-four hours." Friedleben⁷ found experimentally, as far back as the middle of the nineteenth century, that the thymus gland can shrink to one-half its former size in the first days of hunger; hence, for the determination of normal weights he used only glands that were obtained from cases of sudden death. Based on seventy-two cases, he found the average weight of the gland of full-term newborn babies to be 14 gm. Friedman,⁶ in a recent article, states that the normal average weight of the thymus gland of a newborn infant is about 10 gm but this is merely his impression, and not based upon actual weight determination. Boyd⁸ states that although the variability of the thymus gland is high at all ages, it averages approximately 20 gm at birth, 28 gm at eight years, birth size at the age of sixteen and gradually decreases to about 15 gm in late adult life. On the other hand Clark⁹ in an analysis of forty thymus glands from infants, twenty of whom were in the first trimester of life, found that the gland at birth averaged 34 gm and rapidly decreased during the first six months, after which a gradual secondary enlargement ensued. *The concept of a pathologic thymus arose, therefore, from misconstruing the normal prominent thymus found at autopsy following sudden deaths for a constitutional abnormality, and from construing the small involuted thymus resulting from inanition as the normal thymus.* The most commonly quoted average weights of the thymus gland in relation to age are those of Hammar¹⁰ which represent the weights of the thymus of individuals who died from accidents, homicide or suicide.

TABLE I

AGE	WEIGHT IN GM
Full term newborn	15-15 gm.
1-5 yr	25-80 gm.
6-10 yr	29-42 gm.
11-15 yr	29-41 gm.
16-20 yr	26-24 gm.
21-25 yr	21-05 gm.
26-30 yr	19-54 gm.
31-35 yr	20-17 gm.
36-45 yr	19-03 gm.
46-55 yr	17-82 gm.
56-65 yr	14-30 gm.
66-90 yr	14-06 gm.

Hammar, who carefully estimated the exact amount of parenchyma minus the fat and connective tissue and counted the number of Hassall's corpuscles, found the thymus enlarged in only two of fourteen cases of "thymic death." Boyd says that a graphic presentation of Hammar's data indicates that the parenchyma decreases sufficiently after puberty to lower the total weight of the thymus, even though the fat and connective tissue are increased in amount.

Table II is said by Marine to represent the most commonly quoted average weights of the thymus gland in relation to age.

TABLE II
WEIGHT OF THYMUS IN GRAMS

AGE	FRIEDLEBEN 1858	VON SURY 1908	HAMMAR 1906	SCHRIDDE 1923	BRATTON 1925
Newborn	14	14	13	13	11
1 5 yr	(1 9 mo) 20	22	23	17	24
6-10 yr	(9 mo 2 yr) 26				
11 15 yr	(3 14 yr) 26	29	26	20	29
16 20 yr		32	38	25	27
21 25 yr	(15 25 yr) 22		26	20	
26 35 yr			25	19	
36 45 yr	3		20	14	
46 55 yr			16	10	
56 65 yr			13	7	
66 75 yr			16	4	
			6	3	

ROENTGENOLOGIC EXAMINATION

The frequency with which various investigators find enlargement of the thymus gland on roentgenologic examination is subject to a great many variable factors, including the patient's age when the films were taken, the position in which the individual investigator examined the patient by roentgen ray, the interpretation of the roentgenogram, whether or not it was based upon the anteroposterior view or in conjunction with the lateral view, the moment the pictures were taken, whether only on inspiration, on expiration, or both. Furthermore, Hasley's and De Tomasi's¹¹ work with rapid x-rays (about five pictures in two seconds, taken on a reel) demonstrates that the thymus gland varies in size, depending upon the phase of the cardiorespiratory cycle in which the picture was taken. Birk and Schall¹² report finding hypertrophy of the thymus gland in only four out of 1,000 newborn infants. Perkins¹³ examined 700 children and made a roentgenologic diagnosis of enlarged thymus in thirty, or 4 per cent. Friedman's⁸ study of infants under one year, who were radiographed for various reasons, revealed a residual or hyperplastic thymus in less than 5 per cent of those examined. Bliss,¹³ in a study of 1,400 newborn infants, found that seventy, or 5 per cent, showed dangerously enlarged thymus. Saupe¹⁴ was only able to diagnose definite hypertrophy of the thymus

in six out of 100 newborn babies that were examined roentgenologically Mosher¹⁵ found an enlarged thymus gland in 7 per cent of children between the ages of two and sixteen years. Podlasky and Kohn¹⁷ examined 100 consecutive newborn infants presumably in the anteroposterior position only; thirty-five showed definitely enlarged thymus, none of them, however, showed associated symptoms. Singleton¹⁸ found enlarged thymus in 35 per cent of the newborn; he however based his conclusions on roentgenograms taken only in the anteroposterior position. Liss¹⁹ found that in 42 per cent of the infants examined by x-ray within forty-eight hours after birth there were thymic shadows measuring more than 3 cm wide; these shadows he interpreted as enlarged and pathologic. Spontaneous retrogression and disappearance of this shadow took place in the majority of these cases, some, however, persisted to the second year. Peterson and Miller²⁰ found in their series that 43 per cent had enlargement of the thymus gland. Hardy²¹ demonstrated enlargement of the thymus gland in 50 per cent of symptom free infants. Johnston and Howard²² found from 42 to 50 per cent of normal symptom free newborn babies with enlarged thymus shadows by x-ray. From a total of 1,074 newborn babies our own figures show 322 infants with enlargement; an incidence of 30 per cent. On excluding from our figures 150 infants that showed +1 (moderate lateral) enlargement the incidence drops to 16 per cent. The school that claims that the large thymus causes symptoms through pressure will not object to the elimination of the 150 cases that showed a +1 enlargement, that is, the mildest degree of hypertrophy. However, the group that maintains that the hypertrophied thymus gland causes symptoms through an increased or perverted chemical secretion will not permit the elimination of these 150 cases from our figures and for that group the incidence of 30 rather than 16 per cent would be more acceptable. We see therefore that in the medical literature the figures on the occurrence of enlargement of the thymus gland on roentgenographic examination vary from 0.4 per cent to 50 per cent. This denotes considerable difference of opinion and most important of all these differences are predicated upon esoteric concepts of normality.

Randall²³ in a study of eighty-eight autopsies at the Children's Memorial Hospital of Chicago between January 1, 1930 and March 1, 1931 found only one definitely enlarged thymus giving a percentage of 1.1 per cent. The one child in whom he found a large thymus was nineteen months old, and the weight of the gland was 45.5 gm; this child however had no symptoms referable to the thymus or respiratory system. The cause of death was shock and hemorrhage during a two-hour operation for osteomyelitis. Rehner²⁴ investigated 200 children, sixty-eight of whom came to autopsy. The chief symptom in his cases was an inspiratory congenital stridor. In most of the cases there were medium sized and in several, only small thymus glands. In the cases

showing large thymus glands (45 to 46 gm), there was no congenital stridor, which, the author remarks, confirms Finkelstein's skepticism concerning the existence of a thymic stridor

AUTHORS' STUDY

Our investigation consisted in the study of 1,074 newborn infants who were routinely examined by x-ray for enlargement of the thymus gland. These babies were born between January 13, 1930, and April 6, 1932, at the Jewish Hospital, Philadelphia. The number of patients who were actually given x-ray examinations was over 2,000, but we limited our study to those who had lateral x-ray pictures taken as well as anteroposterior, both on inspiration as well as on expiration. Exposures were made with the babies in the recumbent position at skin target distance, that is, 36 inches from the surface of the infant. The pictures were all taken according to the directions of Pancoast and Pendergiass as followed in the Department of Roentgenology at the University of Pennsylvania. When the anteroposterior pictures were taken, the arms of each infant were held above the head, the head was kept exactly straight and in the midline, midway between flexion and extension. For the lateral view, the arms were held downward and backward, and the head was held raised so that the neck was absolutely straight with the body and exactly midway between flexion and extension. This technic is not only superior to the other methods of roentgenography of the thymus gland, but it also gives a correct view of the larynx, so that if buckling of the trachea is seen, it would be due to actual pressure rather than the way the head was held during the taking of the roentgenogram. These babies included private as well as ward deliveries and were all routinely examined by x-ray, irrespective

TABLE III
AGE AT TIME OF ROENTGENOLOGIC EXAMINATION

NO OF INFANTS	AGE IN DAYS	NO OF INFANTS	AGE IN DAYS
62	1	10	9
74	2	3	10
53	3	4	11
46	4	4	12
25	5	1	13
15	6	1	14
11	7	1	16
9	8	1	21
		1	3 mo

of whether or not they had symptoms referable to enlargement of the thymus gland. The majority of the babies was examined during the first week, a very small number during the second week, and only four infants between the second and twelfth week of life.

Out of the 1,074 newborn babies who were examined anteroposteriorly by x ray as well as laterally on inspiration as well as expiration, 322, or 30 per cent, were reported to show thymic enlargement. The sexes were almost equally divided, 157 males and 155 females. Almost one half (142) of the infants who showed enlargement of the thymus gland were first born.

142 first born	5 sixth born
83 second born	1 seventh born
47 third born	2 eighth born
71 fourth born	2 ninth born
7 fifth born	2 tenth born

We classified the 322 cases into four groups, the subdivision being based upon the direction and degree of enlargement reported roentgenologically. We assumed that an enlargement of the thymus gland in its anteroposterior diameter, which gave rise to compression, displacement, or other encroachment upon the trachea, was of greater significance than a lateral enlargement thus favoring slightly the school that claims that "thymic symptoms" are the result of mechanical pressure rather than an excessive thymus secretion. Furthermore, Noback's²⁵ anatomic studies of the thymus gland in the newborn and early infancy confirm the long held suspicion that mere enlargement of the thymus gland shown on anteroposterior photography does not necessarily indicate a thymus of pathologic possibilities. He says that "with the initiation of respiration and the resultant expansion of the lungs, pressure is exerted by these organs against the sides of the thymus. This pressure results in a narrowing of the thymus and is evident in children who have lived but one half hour. With increased expansion of the lungs and resulting increase in pressure upon the sides of the thymus, a flattening of the convex sides occurs and later deep depressions are developed. Along with this narrowing of the thymus, an elongation of the gland occurs and it is extended inferiorly over the surface of the heart. The outline of the thymus in the late fetus and in the still born child is similar to that described by many roentgenologists as 'enlarged or hypertrophied.' In this latter it seems we have normal glands which as yet have not been fully narrowed by the lungs. It is quite probable that many thymi may retain this broad type for several years and yet not be pathologic. The classification of our cases follows:

Plus 1—Moderate lateral enlargement of one or both lobes with no compression of the trachea.

Plus 2—Definite lateral enlargement of one or both lobes with no compression of the trachea.

Plus 3—Moderate lateral enlargement of one or both lobes with definite compression of the trachea.

Plus 4—Definite lateral enlargement of one or both lobes with definite compression of the trachea.

Taking the midspinal line as the longitudinal line of departure and a point immediately above the indentation of the right side of the heart with the great vessels as the horizontal line, we measured on the anteroposterior plate taken during expiration, the width of the shadow of the supposed thymus gland to either side of the longitudinal line and above the horizontal line. The shadows that measured more than 1.5 cm. to the right or to the left of the midline, or both, were those which were designated as "definite enlargements", the shadows that were less than 1.5 cm. wide to either or both sides of the midline were called "moderate enlargements". Practically most of the shadows were of the high type, that is, were above the horizontal line, many of them were distinctly columnar in character, and a few were of the lobated type.

Forty-five of the newborn babies examined showed a +4 thymic enlargement, fifty-one were of the +3 type, seventy-six belonged to the +2, and 150 cases were of the +1 type of enlargement. If we eliminate the 150 cases which belong to the +1 type, that is, babies who showed only moderate lateral enlargement with no encroachment upon the trachea, and in which the roentgenologist recommends as a rule, "No treatment indicated unless symptoms present," there would remain only 172 cases that showed significant enlargement of the thymus gland, an incidence of 16 per cent.

The symptoms usually said to be associated with enlargement of the thymus gland are inspiratory or expiratory stridor (the former being more common), crowing, dyspnea (continuous, intermittent, or paroxysmal during crying or feeding—at times so slight as to comprise noise rather than difficult breathing), dysphagia, cyanosis (as a rule never continuous), asphyxia, vomiting simulating pylorospasm, choking or brassy coughing (occurring sometimes only during feeding), and rarely, retraction of the intercostal spaces. In marked enlargement, some authors claim that the gland may even be palpable in the suprasternal notch and that there may be a failure of the larynx to move downward during inspiration because it is held up by the thymus gland. Another sign sometimes given is the improvement or disappearance of the thymic symptoms on extension of the head. Those who claim that they are able to detect the thymus gland by percussion report dullness in the second interspace to the right and left of the sternum, usually continuous with cardiac dullness. Holt and McIntosh²⁸ state that "the diagnosis of thymic enlargement is often wrongly made on clinical evidence. In the majority of patients who have been brought to us with this diagnosis already made on the basis of stridor, cyanotic spells, or convulsions, some other condition has been responsible—most commonly deformity or disease of the larynx, less often atelectasis, congenital malformation of the heart, or even tetany." As a matter of fact, the conditions that one

should always consider when a diagnosis of thyroid enlargement is made are (1) atelectasis (2) cerebral hemorrhage, (3) congenital heart disease (4) laryngeal anomalies or infections (5) bronchitis or pneumonia, (6) large mediastinal glands, (7) retropharyngeal, peritonsillar or cervical abscess (8) asthma, (9) laryngospasm or tetanus of the newborn (10) congenital laryngeal stridor, the diagnosis of which condition we believe, is not made sufficiently often (11) micrognathia (12) large adenoids, (13) breath holding (14) macroglossia, (15) tongue swallowing, or (16) foreign body in pharynx or larynx

Tucker²⁷ says that "in an infant the entrance to the larynx is at an angle from behind forward and downward toward the glottic lumen. With descent of the larynx, as the child cries, the epiglottis assumes a more nearly vertical position, making the axis of the lumen at the entrance of the larynx more nearly in the line with the subglottic larynx and trachea. An increase in this angle of entrance into the larynx in certain types of infantile larynx may become one of the factors in the production of so-called congenital stridor." He states further that "a subglottic diameter of 4 mm. is to be considered an actual congenital stenosis when it is found in an otherwise normal infant." Thus it seems to us, should be added as another possible cause of the so-called "thyroid syndrome." That stridor is probably one of the most common symptoms of so-called thyroid enlargement is emphasized by Tucker²⁷ when he says that "probably the most frequent condition in which the laryngologist is asked to give an opinion in infants is so-called congenital stridor and the most common abnormality found is the exaggerated infantile type of larynx." He also found papillomata and congenital webs of the larynx and, in one case a broad based, flaccid epiglottis which was sucked into the glottis, as conditions which produced stridor in the newborn. In this connection we are purposely quoting in detail two cases which Tucker²⁷ reports under the heading "Congenital Stridor and Enlarged Thyroid."

Case 1.—"Infant six months old, congenital stridor since birth with only slight dyspnea. X-ray was interpreted as showing enlarged thyroid. Laryngoscopy showed bilateral posterior paralysis of larynx. Bronchoscopy showed evidence of tracheal compression. Tracheotomy relieved the symptoms."

Laryngeal paralysis is certainly not caused by enlargement of the thyroid.

Case 2.—"Four-month-old infant, congenital stridor and retraction of suprasternal notch and tip of sternum since birth. The x-ray showed positive evidence of thyroid enlargement. A series of x-ray treatments were given, and the enlargement disappeared, but the stridor persisted and the dyspnea increased. The laryngoscopy showed the mucous membrane of the larynx inflamed but the larynx normal. On inspiration there was marked indrawing of the aryepiglottic folds and arytenoids. As the symptoms increased a tracheotomy was done."

"In this child," Tucker comments, "the symptomatology was primarily due to the condition of the larynx although there was definite

evidence of enlarged thymus The dyspnea was not relieved because there was a congenitally small larynx, the subglottic measurements being 4 mm "

Two cases of our own illustrate the pitfall of error that one is liable to in the interpretation of stridor in its relationship to a roentgenologically enlarged thymus

Case 1—H K, female, five days old, three weeks premature. Birth weight 6 pounds, 3 ounces Routine x ray picture of chest revealed no enlargement of thymus gland At two months of age the baby developed a marked laryngeal stridor which disappeared only when asleep X ray examination of chest at that time was reported as follows "There is a moderate degree of nodular enlargement of the thymus This displaces the trachea to the right The trachea is normal in size The heart, lungs, and diaphragms present normal appearances " Against the authors' advice, and following the recommendation of the roentgenologist, the baby was subjected to five x ray treatments, following which another x ray picture of the chest was taken (one month after the above quoted report) The report follows "My examination shows complete recession of the enlarged thymic shadow The trachea at this time occupies the central position, there being no evidence of displacement or compression The heart is normal in size, shape, and position The lungs present a comparatively normal appearance "

In spite of the x-ray treatments, which brought about a shrinkage of the thymus gland and a return of the trachea to its normal position, the stridor continued, evidently not due to the enlarged thymus reported, but to laryngeal stridor per se The roentgenologist was apparently satisfied in that he had brought about a normal thoracic picture, however, the child's stridor continued until she was past one year of age

Case 2—M H, male, birth weight 8 pounds, 5 ounces Chief complaint whistling stridor since birth Physical examination showed nothing to account for this Despite advice to the mother that the symptom would probably disappear as the child grew older, she, having heard the gospel of the enlarged thymus from her friends, insisted upon an x ray picture This was made and the roentgenologist's report follows "There is marked bilateral enlargement of the thymus gland There is slight compression upon the trachea " This baby was subjected to two x ray treatments without any relief At eight and a half months the child still showed the same type of whistling stridor although the roentgenogram of the chest no longer revealed any thymic enlargement

The following two cases are examples of the growth of the thymus gland after birth —

Case 3—C D, male, was routinely examined by x ray five days after birth, and the picture showed an enlarged thymus of a + 2 type As the baby had no symptoms, he was not subjected to treatment At seven weeks of age he was admitted to the hospital on account of a febrile condition, and his chest was again examined by x ray and showed a + 4 enlargement of the thymus gland In spite of this marked enlargement, the baby showed no symptoms relative thereto and, had it not been for the accidentally taken picture, one would never have known that the gland enlarged from a + 2 to + 4 type

Case 4—J A, male one day old Routine x ray examination of the chest showed a + 2 enlargement of the gland. The roentgenologist's report follows "Thymus showed distinct lateral enlargement with some encroachment upon the trachea posteriorly" Two and one-half months later, he was readmitted to the hospital on account of symptoms of pneumonia The x ray picture of the chest showed a + 4 enlargement of the thymus gland The trachea was diverted to the right The upper lobe of the lung showed a pneumonic infiltration It is conceivable that the diversion of the trachea to the right may have been due to the negative pressure effect exerted by the consolidated lung on the right side rather than the + 4 enlargement of the thymus gland.

That stridor may be caused by nasal obstruction is illustrated by the following case —

Case 5—J C., male birth weight 7 pounds, had marked stridor since birth and marked indrawing of tip of sternum and suprasternal notch on inspiration. The clinician who examined the infant diagnosed enlargement of the thymus gland as the cause of the symptoms. The x ray picture of the chest showed no enlargement of the thymus gland and no compression stenosis of the trachea. The cardiac silhouette however, was increased in all its diameters and the roentgenologist made the diagnosis of congenitally enlarged heart The stridor persisted until six months of age when relief was afforded the retronasal obstruction by removal of very large adenoids Very soon after the operation the stridor disappeared

Of the 322 newborn infants that showed enlargement of the thymus gland on x ray examination, 276 showed no symptoms thirty-one showed vomiting eight suffered from cyanosis, three had vomiting and cyanosis two had vomiting and dyspnea two suffered from vomiting cyanosis dyspnea, and choking We feel that simple vomiting in itself should not be considered as a symptom of enlargement of the thymus gland for that symptom alone occurred with almost equal frequency in the group of infants that showed no enlargement of the thymus gland in other words simple vomiting occurred in 96 per cent of the babies who showed enlargement of the thymus gland and in 8 per cent of a random group of 100 cases that showed no enlargement Pylorospasm was diagnosed once in the group of 100 cases that showed no enlargement of the thymus gland It also occurred once among the 322 cases that showed roentgenologic evidence of thymic enlargement, and that was a baby with a + 4 enlargement Out of the 322 cases therefore only fifteen showed symptoms that might be referred to the thymus gland making a percentage of 4.7 Of these fifteen infants that showed both so called 'thymic symptoms' and enlargement on x ray examination two were of the + 1 type, four of the + 2, five of the + 3 and four of + 4 type When we consider the entire group of 1074 babies that was investigated we see that fifteen out of 1074 showed symptoms that might be referable to the thymus gland or 1.4 per cent of all patients showed possible thymic symptoms In nine of the fifteen patients showing thymic enlargement by x ray there was also some other condition that

might have been responsible for the symptoms. The appended list enumerates the nine cases that showed thymic enlargement.

- 1 Atelectasis of right lung and +2 enlargement Improved without treatment
- 2 Atelectasis of right lung and +2 enlargement Two x-ray treatments
- 3 Atelectasis of left lung and +1 enlargement
- 4 Atelectasis of both lungs and +2 enlargement Treated
- 5 Atelectasis of left lung and +2 enlargement Treated, improved
- 6 Atelectasis of right lung and +1 enlargement No treatment improved
- 7 Tracheo esophageal fistula and +1 enlargement Death
- 8 Cerebral hemorrhage and +2 enlargement At autopsy thymus was found to be only 1 inch wide and 1 inch long, with practically no depth

We see thus that out of fifteen cases showing x-ray evidence of enlarged thymus and symptoms, in nine cases there was some other cause than large thymus present. *This reduces to six, or 19 per cent, the number of babies in whom the symptoms could not with any degree of certainty be ascribed other than to the enlarged thymus.*

Out of 752 newborn babies that showed no thymic enlargement, thirty-one suffered from dyspnea and cyanosis, or dyspnea, cyanosis, and vomiting. The causes of these symptoms were as follows: twenty-four had atelectasis of the lungs (ten on the left side, eleven on the right side, and three in both lungs), two had cerebral hemorrhages, one cerebral hemorrhage with atelectasis, one pylorospasm. Two suffered from cyanosis and dyspnea that could not be accounted for. We see, therefore, that almost an equally large number of babies showed symptoms without x-ray evidence of enlargement of the thymus as those who did show roentgenologic evidence of enlarged thymus, the exact percentage being, in the former, thirty-one cases out of 752, or 4.1 per cent, and in the latter, fifteen cases out of 322, or 4.7 per cent. *Most important is that two babies in 752, or 0.4 per cent, had "thymic symptoms" with negative x-ray findings.*

Eight of the infants in our investigation came to autopsy. Two of them belonged to the group that showed x-ray evidence of enlargement of the thymus gland. One case was a +2 enlargement but at autopsy the thymus gland was found to be unusually small, 1 inch wide and 1 inch long with practically no depth. The causes of death were cerebral hemorrhage and bronchopneumonia. The other case showed a +1 enlargement, and the autopsy showed a very small thymus gland. The symptoms during life were cyanosis, choking during feeding, regurgitation, and vomiting. The autopsy disclosed esophageal and duodenal occlusion and a tracheo-esophageal fistula. The remaining six cases belonged to the group that showed no enlargement of the thymus gland.

three of them died of cerebral hemorrhage, one of complete atelectasis of the left lung, and two of atelectasis associated with pneumothorax.

Out of 322 cases that showed thymic enlargement, 131 or 41 per cent received x ray treatment, ninety five received one treatment, and thirty six received two or more treatments. All of the forty five + 4 cases received x ray treatments, thirty five received one radiation while ten received two or more treatments. Out of the fifty-one + 7 cases fifty received treatment, in this group thirty five received one while fifteen received two or more treatments. Out of the seventy six + 2 cases only twenty-eight were treated, eighteen having received one, and the remaining ten two or more treatments. Only eight infants were treated out of the 150 + 1 cases, of which seven received one radiation while one received two. In other words 131 infants received x ray treatment for enlargement of the thymus gland, despite the fact that only fifteen had symptoms customarily referable to an enlarged thymus. As stated elsewhere in nine out of fifteen infants that showed x ray evidence of enlarged thymus and so-called 'thymic symptoms' there were some other causes than large thymus operable. We see, therefore that 131 babies were treated, in spite of the fact that only six actually showed symptoms usually referred to the thymus gland and also x ray evidence of enlargement. We cannot help being forced to the conclusion that a great many of the newborn babies are unnecessarily subjected to a method of treatment the exact immediate effect of which we do not know and the ultimate results of which are also beyond our sphere of present knowledge. In this connection the warning given by Morse²² is timely, namely that "the demonstration by the roentgen ray of what is assumed to be an enlarged thymus does not prove that such symptoms are connected with it. Even if the symptoms cease after shrinkage of the thymus with the roentgen ray, it does not prove that they were due to a change in the secretion of the thymus. They cease many times without such treatment and, if the cessation occurs after treatment with the roentgen ray it may just as well be due to the disappearance of the real and unknown cause." Griffith and Mitchell²³ conclude that "the indiscriminate exposure to the roentgen ray of every newborn baby who supposedly has an abnormally large thymus shadow yet is without clinical symptoms, is a procedure to be deprecated as not only unnecessary, but possibly harmful."

COMMENT

Friedleben's⁷ original conclusions, which are based on classic experiments and clinical studies of the thymus gland could be resurrected with propriety and with a great deal of profit. His dictum, "Es gibt kein asthma thymicum" (There isn't any thymic asthma), is as deserving an observation as that of the fallacy of "laudable pus." While rarely there may be some one or more symptoms such as dyspnea and

stridor due to pressure of the thymus gland, certainly in newborn babies true or actual thymic asthma hardly, if at all, exists. Even the discovery of an enlarged gland in cases of congenital laryngeal stridor does not necessarily prove that pressure from the thymus is the cause of the symptom. Weill-Halle and Dieytus-Sec³⁰ performed thymectomy without sufficient improvement of the stridor to permit the deduction that the enlarged thymus was responsible for the stridor.

There is no question that occasionally one sees a case of marked dyspnea and choking that is actually due to a large compressing thymus which could be demonstrated both anatomically as well as bronchoscopically. Jackson,³¹ in his pioneer and classic studies, reported undoubted cases of tracheostenosis which he observed bronchoscopically, in which the narrowing of the tracheal orifice was due to an enlarged thymus, but those cases are rather rare and are not nearly as commonly found as the diagnosis is made. Chevalier Jackson,³¹ in a personal communication to the authors, says that a partial review of his records revealed notes of endoscopic findings of thymic compression of the trachea in 127 cases out of 2,182 children examined bronchoscopically for various indications, including foreign body present or suspected. This makes the incidence of 5.8 per cent of thymic compression in Jackson's cases. Of the 127 cases, 114 children had respiratory symptoms (asthmatoïd wheeze and stridor), in the others the compression was not sufficient to cause obstructive symptoms. *The diagnosis was made bronchoscopically.* Undoubtedly the majority, if not all, of the patients in Jackson's series were not newborn babies—which is the problem that concerns us—but older children that were brought to him for various disorders associated with the respiratory system, most of them being children who were suspected of, or actually suffered from, foreign bodies in the respiratory or upper alimentary tracts. It is erroneous for most authors to quote Jackson's figures on tracheostenosis due to pressure by an enlarged thymus when referring to the newborn baby. As careful an observer as Finkelstein⁴ says that he never saw a case of so called thymic asthma in which there was actual evidence of compression of the windpipe. He states that the cases which he had earlier diagnosed as thymic and which were confirmed by x-ray examination, on more critical analysis later proved to be due to some other condition. Abt and Helmholtz³² also doubt the clinical existence of thymic asthma. Even though tracheal compression has been carefully looked for by pathologists, very few have reported positive findings. Marine¹ sums up his review very succinctly. He concludes that "in the great majority of the cases, no clinical or postmortem evidence exists that death is caused by compression and that the explanation of thymic asthma or thymic death is not so simple, or at least that pressure-effects are inadequate in the absence of a constitutional predisposition to account for death." Symmers³³ reports that out of 5,652 autopsies on adults as well as children at the

Bellevue Hospital status lymphaticus was found in 457 cases or 8 per cent. The heaviest thymus in that group weighed 70 gm. "But," remarks Simmers, "according to Tammassia, experimentally the thymus must weigh at least 180 grams before it will compress the trachea."

While we do not want to appear too dogmatic in maintaining that enlargement of the thymus gland does not produce so-called "thymic symptoms," it certainly appears from our study of the literature as well as our own cases, that the etiologic relationship between thymic hypertrophy and the 'thymic syndrome' is a very questionable one and that the condition of true tracheostenosis in the newborn due to enlargement of the thymus is extremely rare. Griffith and Mitchell²² say that "a study of the literature together with our own experience appears to us to justify the statement that there is little if any correlation between size of roentgenographic shadow and clinical symptoms which could be attributed to enlargement of this organ." It appears to us that it certainly would seem advisable to divide the cases of so-called "enlarged thymus" into (1) symptomatically enlarged thymus and (2) non-symptomatically enlarged thymus. The former should only be diagnosed where the symptoms cannot be explained by any of the aforementioned conditions that give the same symptom-complex and where the x-ray pictures—taken both on inspiration and expiration in the lateral as well as the anteroposterior views—show unmistakable evidence of enlargement of the thymus particularly if the gland shows a +3 or +4 type of hypertrophy.

SUMMARY

1 Opinions are adduced from the medical literature to show that there apparently exists neither a relationship between so-called "enlarged thymus" of the newborn and sudden thymic death nor between the "enlarged thymus" of the newborn and status lymphaticus.

2 The normal size and weight of the thymus gland are discussed and emphasis is laid upon the great fluctuations in the weight of the normal thymus and of the variations of the weight of the gland in health and disease.

3 The literature is partially reviewed on the incidence of the diagnosis of enlarged thymus as made by x-ray examination. Our investigation includes 1074 newborn infants, of whom 322 or 30 per cent showed roentgenologic evidence of "enlarged thymus."

4 A roentgenologic classification of enlargement of the thymus gland is offered in which the +1 type represents the slightest breadth enlargement of the gland, and +4 the most marked width and depth enlargement.

5 Almost 50 per cent of the 322 newborn infants that showed enlargement belonged to the +1 type. The school, therefore, which maintains

that the "thymic syndrome" is caused by pressure would admit elimination of the 150 cases of the +1 type, thus reducing the incidence of roentgenologically enlarged glands to 16 per cent. For the group that claims that the "thymic syndrome" results from increased chemical secretion, the incidence of roentgenologically "enlarged thymus" would have to remain 30 per cent.

6 Of the 322 infants in whom a roentgenologic diagnosis of "enlargement" was made, 150 showed a +1 hypertrophy, seventy-six were +2, fifty-one of the +3 type, and forty-five belonged to the +4 group.

7 Of the 322 babies who showed roentgenogram evidence of "enlargement," 276 showed no clinical symptoms, thirty-one suffered only from vomiting, a symptom that occurred with almost equal frequency in a group of 100 unselected newborn who had no x-ray evidence of "enlarged thymus", only fifteen of 322 infants, or 4.7 per cent showed symptoms that might be referred to an enlarged thymus gland. Of these fifteen, two belonged to the +1, four to +2, five to +3, and four to +4 type.

8 Of the entire group of 1,074 babies, only fifteen, or 1.4 per cent, showed possible thymic symptoms. In nine of the fifteen infants there was also some other additional condition (atelectasis, cerebral hemorrhage, and in one, tracheo esophageal fistula) that might have been responsible for the symptoms, thus leaving only six babies or 0.56 per cent in whom the symptoms could with any degree of certainty be ascribed to an enlarged thymus gland only.

9 Of the 322 infants with enlarged shadows, 131 received treatments by x-ray, in spite of the fact that only six actually showed symptoms that might be referable to thymus gland.

10 The suggestion is made that hereafter cases be divided into (1) symptomatically enlarged thymus gland and (2) nonsymptomatically enlarged thymus gland, and that the former be diagnosed only when, in the presence of pressure symptoms, there is unmistakable roentgen evidence of enlargement, particularly if the hypertrophy be of the +3 or +4 type, and when all other conditions elsewhere mentioned have been excluded.

CONCLUSIONS

1 The diagnosis of "enlarged thymus gland" in the newborn is made entirely too frequently and is often based merely on the roentgenologist's findings.

2 True hypertrophy of the thymus gland in the newborn causing tracheostenosis and the typical chain of symptoms is much rarer than is commonly believed to exist.

3 It is considered inadvisable, unnecessary, and economically inexpedient to examine routinely by x-ray every newborn infant for roentgenographic evidence of enlargement of the thymus gland.

4 There is no indication for x-ray treatment of the thymus gland in the newborn unless the infant shows a symptom, or chain of symptoms, pointing to hypertrophy of the thymus gland, and for which symptom the clinician has carefully excluded other causes, and wherein the roentgenologist has demonstrated unmistakable evidence of depth of enlargement

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pharyngeal wall. The uvula is seen submerged in the saliva. The cough is weak, and, although the patients are able to bring the mucus to the pharyngeal space, they are unable to expectorate. Respirations are somewhat labored, but there are no supra- or infrasternal retractions. As the column of air passes through the pool of mucus during expiration, it produces a gargling sound. The soft palate hangs like an apron and does not move on articulation. The nasal cavity therefore cannot be shut off from the mouth. As a result the voice is nasal, and certain consonants are altered ('b' becomes 'm', 'd' becomes 'n,' etc.) so that articulation as a whole is indistinct. This indistinctness of articulation is increased when the patient stoops forward, it diminishes or even disappears on his lying with the head thrown backward, since in the latter position the paralyzed soft palate tends to fall back by its own weight and shuts off the nasopharynx. Swallowing is difficult or impossible especially of liquids which, during the act of deglutition, regurgitate into the nasopharynx and escape through the anterior nares. Epigastric pain is a frequent complaint. The temperature is the only prognostic sign as to the spread of the infection. As long as the temperature remains elevated the infection is liable to spread to some other part of the bulb and cord. We have never seen paralysis extend after the temperature has remained normal for forty-eight hours. Recovery in these cases is very slow and the signs and symptoms may persist for many weeks. Complete palatine paralysis comprised 51 per cent of the total number of bulbar cases.

The patients described* do well and eventually recover completely. The following patients, however, do not present as favorable a prognosis and are the cause of utmost concern to the physician.

When in addition to the signs and symptoms of the two types described above parts of the vagi which supply the cardiac, respiratory and gastrointestinal systems are affected, the following result: gastric dilatation with vomiting and pain, loss of the oculocardiac reflex, tachycardia and irregularity of the heart (due to paralysis of the cardiac inhibitory fibers) and slowness and irregularity of respirations. Drowsiness or extreme irritability and restlessness may also be noted.

If the damage to the vagal nuclei is minimal and transient due to edema, we may hope for a disappearance of the above dangerous signs and symptoms within a short period with ultimate recovery. However, when there is more or less permanent involvement of the affected parts due to hemorrhage or destruction in the bulb the outlook is grave. The vomiting continues at intervals, the epigastric pain persists, restlessness increases, the quality of the heart action becomes poorer, the tachycardia and irregularity becoming more marked, and a fatal termination

We have not discussed facial paralysis in these groups because the nucleus of the seventh nerve is in the pons and we are describing only bulbar paralysis.

is the result. It is therefore apparent that the gravity of the involvement of the vagi will depend upon the extent and type of the lesion in their nuclei.

The type of bulbar poliomyelitis which, in our experience, has proved to be invariably fatal, is the one in which there is involvement of the vasomotor center. Here, in addition to the picture of vagal damage, the patient presents the syndrome of extreme vasomotor collapse, the pulse is rapid, weak, thready, and of low tension, the respirations are shallow and irregular, the muscles are relaxed, there is mental apathy, the face is expressionless, the skin is cyanotic, cold and clammy, the pupils are dilated, the temperature gradually rises, and the blood pressure falls. Death is the inevitable outcome. The mortality rate in our series of cases was 25 per cent.

TREATMENT

Lumbar Puncture—The consensus of opinion of previous investigators is that lumbar puncture is of therapeutic value in the treatment of all types of poliomyelitis.¹ Our experience with 1,325 cases, of which 29 per cent were bulbar, causes us to feel that lumbar puncture is unnecessary and definitely contraindicated in bulbar poliomyelitis in which paralysis is self-evident. Where the diagnosis is doubtful and a lumbar puncture is essential, a small amount of fluid should be slowly withdrawn.

A brief review of the histology and physiology of inflammation will clearly indicate the reasons for our belief. The capillaries in the affected areas are dilated and injected with acceleration of the blood stream. Soon hemostasis with engorgement and tortuosity of vessels occurs, followed by exudation into the affected part. Occasionally petechiae are also present. The object of the exudation is twofold, to bring antibodies to the inflamed area and to support the capillary walls and prevent their rupture. The pressure of the exuded fluid in the cord proper is therefore equal to the spinal fluid pressure in the subarachnoid space, and the capillary walls are consequently held intact. When the subarachnoid pressure is suddenly released by lumbar puncture the pressure within the cord is similarly released. The spinal cord instantly bulges, the capillaries dilate and blood rushes into them. With the sudden onrush of blood, oozing takes place from the finer blood vessels, and additional capillary ruptures in the bulb are liable to occur and in many instances probably do occur. When the bulb is the site of hemorrhage, enormous edema results, the vital centers are strangulated, and death is sure to follow.

Furthermore, it is claimed by previous investigators in this field that repeated lumbar puncture diminishes intracranial pressure, and head ache, vomiting, and hyperesthesia disappear. It is common knowledge among clinicians that children suffering from acute poliomyelitis rarely

vomit more than once and that the headache subsides in one or two days with or without lumbar puncture. These two symptoms cannot, therefore, be attributed to persistent increased intracranial pressure since they subside so rapidly. In the light of present knowledge of the pathology of poliomyelitis, one is inclined to attribute the hyperesthesia to posterior root infiltration, a constant microscopic finding, rather than to increased intracranial pressure. The hyperesthesia lasts for a long time after the increased intracranial pressure has subsided. We must conclude that repeated lumbar puncture does not benefit the patient, and on the contrary, subjects him to the danger of hemorrhage into the bulb.

Respirator—The use of the respirator is definitely contraindicated in these cases. The respirator is indicated in intercostal, diaphragmatic, and abdominal muscle paralysis in which prolonged artificial respiration is required. No such paralysis is present in pure bulbar poliomyelitis. Paralysis of the respiratory center when and if it occurs, is part of the vasomotor collapse and a phase of the terminal picture.

Drugs—All drugs that depress the respiratory center are definitely dangerous and contraindicated. Atropine sulphate has been advocated and used extensively for the purpose of drying up the secretions in these cases. It must not be overlooked that when given in larger doses atropine sulphate is a depressant of the respiratory center. Therefore we believe that its repeated use is inadvisable.

Postural drainage and suction—Patients who are unable to swallow, either because of partial or complete palatine paralysis, are treated in the following manner.

Upon admission to the hospital and immediately following physical examination the child is put to bed in a prone position upon a hard mattress. The ankles are well padded with cotton and tied by means of a bandage to the foot of the bed which is elevated about two feet so that the head is well down. If the child is restless and insists upon turning, the wrists are attached to the sides of the bed. This posture is maintained to insure drainage.*

Usually there is a marked flow of mucus from the mouth and nose. Frequently however, though most of the secretions are removed in this manner a considerable amount of the mucus may remain in the pharyngeal space and stagnate behind the posterior pillars. In this event there is danger of aspiration pneumonia and the development of catarrhal or purulent otitis media. To diminish the possibility of these complications, suction is instituted by gently introducing a suction catheter into the mouth and throat. The patient usually resents this form of treatment for the first two or three times but he thereafter becomes accustomed to this procedure and willingly submits to it and, in fact, very often begs for it.

Feeding—Since swallowing is impossible and nausea is present, three or four ounces of tap water, at body temperature, are introduced per rectum every four hours by means of a funnel and catheter during the first day. On the next day, in addition to tap water by rectum, hypodermoclyses of 5 per cent glucose in normal saline are started. The use of hypodermoclysis is delayed in order to prevent excessive restlessness during the child's first twenty-four hours in the hospital. Two daily hypodermoclyses and instillations of water by rectum are continued as long as nausea persists. We have found that the restlessness and nausea correspond to the period of temperature.

Nasal gavage is not begun until the temperature has subsided. Regardless of the age of the patient, the amount of fluid in the first gavage should not exceed two ounces, for the child frequently vomits the first food introduced in this manner. The amounts are gradually increased until a maximum of 8 ounces every four hours is reached. This is usually established at the end of twenty-four hours. Henceforth the child takes his nasal gavage without difficulty. The gavage diet given every four hours consists of the following ingredients:

Milk	8 ounces	160 calories
Sugar	2 ounces	240 calories
One egg		80 calories
		<hr/> 480 calories

Children with one-half of the palate paralyzed are usually able to swallow at the end of forty-eight hours. In those with involvement of both sides of the palate, the inability to swallow may be prolonged for as long as six or seven weeks. As soon as the palate begins to move, the patient is placed in a supine position without a pillow, and a semisolid diet is given. The head is then slowly elevated from day to day until the child is able to take nourishment without any difficulty. All these precautions are observed in order to decrease the possibility of the occurrence of aspiration pneumonia.

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CONGENITAL HEART DISEASE

PULMONARY STENOSIS OF INFLAMMATORY AND DEVELOPMENTAL ORIGIN COMPLICATED BY RHEUMATIC HEART DISEASE AND SUBACUTE BACTERIAL ENDOCARDITIS

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THE most frequent type of congenital heart disease found with the symptom-complex of so-called congenital cyanosis is a stenosis of the pulmonary artery with its associated cardiac defects (Abbott¹). In a statistical analysis of one thousand cases of congenital heart disease made by Abbott,² stenosis of the pulmonary artery was found in 110 cases.

The cases of pulmonary stenosis have been divided by Abbott¹ into two groups: first, those in which the 'lesion is purely valvular and has resulted from endocarditis of the pulmonary segments setting in during relatively late fetal life after the cardiac septa have closed' and second, 'the other and much larger group of pulmonary stenosis where the lesion is to be traced to an arrest of development in early embryonic life before the division of the heart into its four chambers is completed.' In the former group of cases which are considered here first as the less complex anomaly, there is a thickening and usually a fusion of the pulmonary cusps with the production of a small, often funnel-shaped, pulmonary orifice which opens off the hypertrophied but otherwise normal cone of the right ventricle, and the pulmonary artery is usually of normal size or may even be dilated; the interventricular septum is entire, but the foramen ovale is usually patent and is not infrequently fenestrated.

In the latter group, the main lesion is not inflammatory or valvular but a true hypoplasia of the pulmonary tract and the interventricular septum presents a defect at the base while the aorta which it will be remembered arises in early embryonic life from the right side of the common ventricle, usually appears displaced to the right arising from both ventricles above the septal defect or entirely from the right ventricle, the pulmonary artery is usually small and thin-walled and the pulmonary valve bicuspid or rudimentary. The cone of the right ventricle is narrowed, or it may (in cases where a septal defect communicates with the cone) be expanded below the cusps into a chamber connected with the sinus of the ventricle by a constricted orifice (persistent lower bulbar orifice).

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At times the stenosis is only transient and the congenital lesion may be progressive leading eventually to an atresia of the pulmonary artery. The aorta then dilates. The pulmonary circulation is usually maintained through a widely patent ductus arteriosus or through branches directly from the aorta (Kugel³). This condition has been described as *truncus solitarius aorticus*.

This case is reported because the clinical and pathologic observations may add to our knowledge of this type of heart disease. The pulmonary stenosis is of the relatively rare type belonging to the group of inflammatory origin superimposed upon a true arrest of development, as evidenced by the presence of a patent intraventricular septum, dextro-position of the aorta and some stenosis of the pulmonary conus (tetralogy of Fallot). Of great interest pathologically is the finding of old, mild, healed lesions of all the heart valves (probably rheumatic) with a superimposed, subacute, bacterial endocarditis, while clinically there was an intense polycythemia with its accompanying vascular changes in the eyegrounds and nail beds.

CASE REPORT

J. E., a Porto Rican girl, aged twelve years, was admitted to the Mount Sinai Hospital on November 4, 1932. The family history was entirely negative. Her birth history was normal, and there was no cyanosis at this time. She had pertussis at two and one-half years and measles at ten years of age. During the past nine years, she had had attacks of transient arthralgia in the knees. There was no swelling, redness, or fever. For the past four years she had had frequent severe frontal head aches and nosebleeds. Her menses began when she was eleven years old and have been regular, the periods lasting three to five days. Her first symptoms were noted at two years of age when she developed evanescence. Her mother stated that she thought the finger nails and toe nails were abnormally curved shortly after birth. Cyanosis was first observed in the lips and nails. It gradually became more progressive, being aggravated by excitement, exertion, or cold. It increased as the child grew older. She complained also of chilly sensations, particularly in her extremities. She was, however, able to play with other children and go to school until she was ten years old when she began to be dyspneic on exertion. This grew progressively more marked, so that at the time of admission she was severely dyspneic and orthopneic. For one year previous to admission she had complained of inability to see clearly, particularly after exertion. Occasionally she had precordial pains. There was no edema, fever, or abdominal pains at any time.

The examination on admission showed an acutely ill child with extreme cyanosis of the lips, face, nose, ears, and extremities. The respirations were rapid, labored, and without pause. The patient was very irritable and in great distress. She complained of inability to see. The temperature was 100° F., the pulse 156, regular and of fair quality, the respirations were forty per minute. The skin had a generalized dusky line and was cold and dry. A number of old purpuric spots were seen over the chest and lower extremities. There was marked clubbing of the fingers and toes. The eyes were inflamed, the pupils were round and regular and reacted to light and accommodation. The sclerae and conjunctivae were cyanotic and congested. The ears were normal except for a bluish discoloration of the drums. The nose and throat were negative. The lymphatics were normal. An examination of the chest

showed the heart to be markedly enlarged to the left, and somewhat enlarged to the right. The rate was rapid and the rhythm regular. A rough systolic murmur was heard over the apex, but more distinctly at the third interspace just to the left of the sternum. The second pulmonary sound was muffled. The lungs were clear. The abdomen was soft and the liver was felt about one and one half fingerbreadths from the costal margin. The spleen was not palpable.

Laboratory Examinations—The blood pressure was 11-/90.

The examination of the eyegrounds (Dr. Minsky) showed the following changes: right eye—the nerve head was crimson in color. The nasal half of the nerve was elevated by the dilatation of the veins and arteries while the nasal margin was indistinct. The arteries and veins were markedly tortuous and glistening. The caliber of the vessels was larger than usual; the branches not ordinarily seen, especially in the macula, being affected. The background had a delicate lavender tint with a crimson base. In the periphery the vessels were larger than usual.

Left eye—the nerve head was similar to the right. The vessels appeared more turgid, and the veins were markedly dilated. The periphery and macula were similar to that described in the right side (fig. 1).

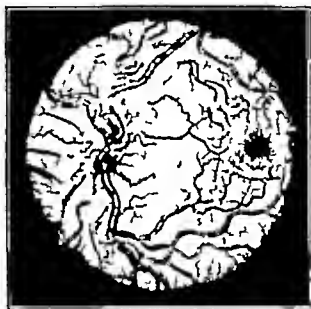


Fig. 1—Photograph of retina made and lent by Robert K. Lambert showing vascular changes.

A microscopic examination of the capillaries of the nail beds (Dr. Leader) showed them to be markedly increased in size. The vessels were greatly lengthened and widened. They were distended with corpuscles moving at an extremely slow rate so that in many loops an absolute stasis was evident. The vessels were also very tortuous and the normal looped contour was entirely distorted. The arterial and venous limbs were approximately the same size. The vessels were not increased in number. There was no evidence of a subpapillary plexus. The background had a purplish, livid hue. The configuration of the vessels was that usually seen in congenital heart disease with polycythemia and advanced clubbing (Fig. 2).

The blood count showed a hemoglobin content of 138 per cent, a red blood count of 10,360,000, and a white blood count of 4,600. The polymorphonuclear neutrophils were 70 per cent, the lymphocytes 22 per cent and the monocytes, 8 per cent. The sedimentation time was over two hours (normal). A urine examination showed a heavy trace of albumin. The blood Wassermann was negative. A blood culture taken shortly after admission was negative. Repeated electrocardiographic examinations (Dr. Hubert Mann) showed high voltage in the main deflection. There was evidence of marked right ventricular preponderance. The P waves were prominent in Leads

I and II, the T wave was prominent and upright in the first lead and sharply inverted in Lead III. The rate was about 130 per minute.

An x-ray examination of the chest showed no abnormality in the lungs. The cardiac shadow was markedly enlarged to the left. The right side showed only a moderate enlargement. The aortic knob was present although it was small. The pulmonary artery pulsation was not visualized, and the second (pulmonary) arc was not prominent or enlarged (fluoroscopic examination). The heart's apex was turned upward on the left in the typical *cœur en sabot* configuration (Fig 3).

Course—Under rest and sedatives, the child improved temporarily. The respirations then became slower and the pulse rate decreased slightly to 120. However, she ran a slight fever daily. About ten days after admission the temperature rose to 102° F and remained at that level. On the fifteenth day in the Hospital, a number of petechial spots appeared on the chest and abdomen. The blood culture at this time was negative. Nevertheless, the presence of a bacterial endocarditis was suspected clinically. The following day she had a severe attack of cyanosis and died.

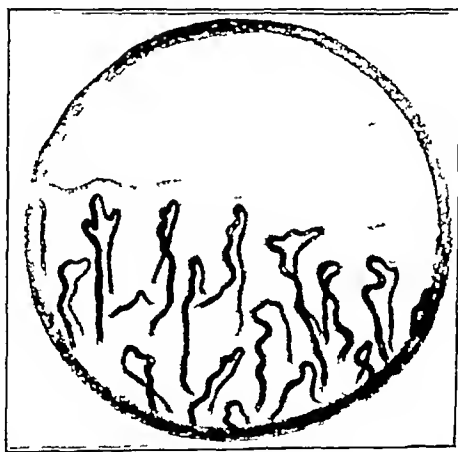


Fig 2—Drawing of capillaries of nail beds as seen under microscope.

Postmortem Examination—(Drs. P. Klemperer, L. Lichtenstein, and S. Siegal) The body was that of a well developed, well nourished girl of twelve years, in complete rigor mortis. The skin was distinctly cyanotic all over. The conjunctivae, palpebral and ocular, were markedly injected and cyanotic. The nails of the fingers and toes were clubbed and blue. There were a few scattered small, rather faint, petechial spots without white centers upon the anterior chest. Prominent dilated veins were noted especially upon the anterior chest wall, but also upon the abdomen and lower extremities. There was no jaundice or edema present. The blood which escaped from the veins was very dark blue and viscid. The jugular veins were engorged.

The abdomen was not distended. The veins of the mesentery and gastrointestinal tract were engorged. The viscera were cyanotic, enlarged, and greatly congested.

Heart The heart was greatly enlarged and had a globular shape. The enlargement was chiefly that of the right ventricle. From a view in situ the left ventricle represented about one quarter of the anterior surface of the heart. This was due to the fact that the left ventricle was much smaller than the right and was displaced posteriorly (Fig 3). The right auricle received, in its normal fashion, the

inferior and superior vena cavae. The right auricle was somewhat enlarged its wall was thickened. The mouth of the coronary sinus was widely gaping. The tricuspid valve presented a diffuse thickening throughout, with numerous blood vessels going to the line of closure where there were large irregular, warty vegetations which were hard and firm and which showed on smear and culture gram positive



Fig 3—Roentgenogram of chest and postmortem specimen of heart as seen in situ.

socii in pairs (Fig 4). The chordae tendinae were only slightly thickened. The right ventricle was dilated, and its wall greatly hypertrophied. The thickness of the right ventricle was 13 mm., and there was a marked hypertrophy of the papillary muscles and a great prominence of the trabeculae carneae. The right outflow tract was much thicker than the inflow tract and the region of the base of the

pulmonary conus presented the greatest hypertrophy of the heart. There was a gaping defect which admitted the index finger in the interventricular septum, near the base of the aorta. The aorta overrode both ventricles. As one followed the right outflow tract upward, one could observe a gradual constriction of the pulmonary conus producing a stenosis at the base of the pulmonary artery. In addition, there was a fusion of the three pulmonary valve leaflets forming a cone with the apex pointing upward and projecting into the pulmonary artery. At the apex of this cone there was a small opening through which blood was forced into the pulmonary artery. There were a few vegetations at the apex of this cone (Fig 4). The pulmonary artery was of normal size above this area. Its walls, however, were very thin, and the vessel in its entirety was collapsed. The course of the pulmonary artery from this point on was normal. There was no opening found between the pulmonary artery and the aorta. The left side of the heart was smaller than the right. The left

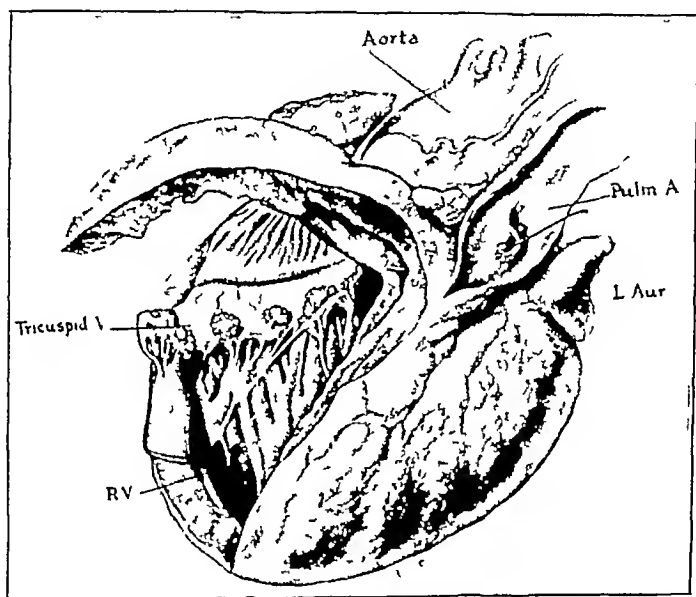


Fig 4—Drawing of the right side of heart showing hypertrophy of the right ventricle (R. V.) large growths of vegetation on the tricuspid valve and probe passing through pinhole stenosis of pulmonary valve.

auricle was of normal size. Its endocardium was only slightly thickened. The foramen ovale was still patent, allowing a coarse probe to pass through it. The mitral valve was diffusely thickened throughout and very well vascularized. Along the line of closure one could see small, shaggy bits of vegetations, which were very flat and minute. Crushings of this vegetation showed gram positive diplococci. The chordae tendineae were not thickened. The left ventricular wall showed only slight hypertrophy, its thickness being 9 mm. There was a dilatation of this chamber. A septal defect at the base of the aorta allowed free communication with the right ventricle (Fig 5). The cavity was globular in shape with a slight bulge at the apex. The interventricular septum bulged from the right side into the left, thereby diminishing the size of this cavity. The aorta took its usual origin from the left side and overrode the right only slightly. There were three cusps with blood vessels at the base of each with vegetations on all three valves. There was

a small irregular growth of vegetation on the aorta. The two coronary arteries had their normal origin and distribution. The aorta showed a small depression which apparently was the ductus arteriosus, and one could follow this inward for about $\frac{1}{2}$ cm. where it was completely closed. Apparently this aperture was not stenosed until later life. The bronchial arteries had prominent mouths and were large.

Diagnosis—Congenital defect of interventricular septum at base with dextroposition of aorta and conus stenosis of right ventricle and valvular stenosis (possibly inflammatory) at pulmonary orifice.

Hypertrophy of right ventricle. Patent foramen ovale. Closed ductus arteriosus. Enlarged bronchial arteries. Chronic valvular disease (rheumatic) of the mitral aortic tricuspid and pulmonary arteries with

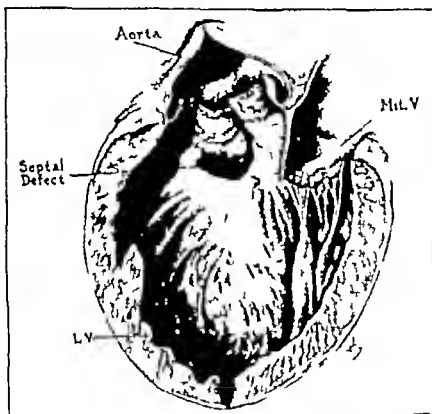


FIG. 5.—Drawing of left ventricle showing septal defect and vascularization of mitral and aortic valves.

vascularization of the mitral aortic and tricuspid valves. Subacute bacterial endocarditis of all valves. Polycythemia. Congestion of viscera.

DISCUSSION

We have presented the clinical and pathologic findings of a thoroughly investigated case of congenital heart disease which is not only of interest in itself, but is important for later work in this field. Not only are we dealing in this instance with the mechanical defect causing cyanosis but also with the well known fact, as emphasized by Abbott,⁴ Lahman,⁵ Wilson,⁶ and others, that these individuals are subject to the development of a bacterial endocarditis and rheumatic heart disease. Wilson,⁶ in an analysis of five hundred cases of heart disease in children, found

that fifty-six, or 11.2 per cent of these children, were patients with congenital heart defects. "Eighteen, or 3.6 per cent of these, also gave a complicating rheumatic history."

The occurrence of a subacute bacterial endocarditis, engrafted upon a bicuspid aortic valve has become a well-known clinical fact due to the work of Abbott⁷ and Lewis and Giant⁸. In one thousand cases of the various types of congenital cardiac defects analyzed² subacute bacterial endocarditis with endarteritis was present in seventy-three, an incidence of 7.3 per cent, occurring most frequently in cases of patent ductus arteriosus and defects of the interventricular septum. In 110 cases of pulmonary stenosis reported, bacterial endocarditis or endarteritis was found in five cases, an incidence of 4.5 per cent. Rost and Fischer¹² and Fischer¹³ found congenital cardiac disease to be present in six of seventy-eight cases of subacute bacterial endocarditis in children whom they either followed or whose cases they collected from the literature, an incidence of 7.7 per cent. Many of the clinical features in these cases are in common with those reported by Abbott⁷ and by Rosler.⁹ Only the more important ones will be summarized.

Of great interest were the *intra-vitam* studies made of the vessels in the eyegrounds and in the skin. The changes in the eyes as pointed out by Ginsburg¹⁰ are in reality due to the presence of a polycythemia. The severity of the lesions, according to this author, is directly proportional to the degree of polycythemia. He reported three cases in which the red blood counts were 6,500,000, 7,600,000, and 9,800,000, respectively. In the last of his cases, histologic examinations were made which greatly clarified the pathologic background of the retinal picture which one sees *intra vitam*. There was marked thickening and hyalinization of the walls of the dilated vessels in the iris, choroid, ciliary body, and retina. In the left eye a large hemorrhagic infarct was present in the periphery of the retina. In the right eye many vessels showed also endothelial proliferation with narrowing and frequently obliteration of the lumen. Numerous hemorrhages were present between the retina and choroid and in the vitreous humor. Our ophthalmoscopic findings are similar to those described by Ginsburg¹⁰. In our case the polycythemia was quite marked, the red blood count being 10,360,000 and the hemoglobin content, 138 per cent.

The capillary microscopy of the vessels of the nail beds showed these to be markedly enlarged, tortuous, and distended with corpuseles which were moving very slowly. This picture is typical of that seen in cases of congenital heart disease with clubbing of the fingers and polycythemia (Lender¹¹). Similar observations have been made by Redisch and reported by Rosler.

The x-ray findings are of interest, inasmuch as a thorough fluoroscopic examination was also made. From the teleroentgenogram the enlargement seemed to be due to the left ventricle. However, a knowledge of

the pathology of this condition from previously reported cases, as well as the bulging of the right auricular contour, indicated that the changes in the right ventricle were greatly responsible for the enlargement and contour of the heart. This was further corroborated by the electrocardiographic findings which are usually associated with a right ventricular preponderance. The lack of pulsation and bulging of the pulmonary artery is explained by the stenosis of the conus, the pinhole opening of the pulmonary valve and the collapse of this vessel. Fig 3 shows a photograph of the heart attached to the lung, in a position similar to that found in life in an attempt to correlate the teleroentgenogram with the position of that organ during life.

It is evident from an analysis of the pathologic specimen that we are dealing with a case of congenital cardiac defect due to a congenital maldevelopment of the pulmonary artery and a secondary inflammatory stenosis of the pulmonary valves. The patency of the interventricular septum points to the conception of a primary congenital defect. The stenosis of the pulmonary valve may have been due either to a non-specific infection or to rheumatic fever. It is interesting to note that since the age of three years the child has had frequent attacks of pains in the joints which pain may have been manifestations of recurrent attacks of acute rheumatic fever. The subacute bacterial endocarditis complicated this picture and hastened the inevitable end.

SUMMARY

A case of congenital conus stenosis of the right ventricle complicated by a valvular stenosis of inflammatory origin with fusion of the pulmonary cusps forming a pinhole orifice has been described. It was further complicated by the presence of a healed rheumatic endocarditis and a fresh subacute bacterial endocarditis.

Complete pertinent clinical and laboratory data have been presented.

We wish to acknowledge our appreciation to Doctor Bela Schick, Doctor Maude Abbott and Doctor Louis Gross for their helpful review of this case.

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770 WEST END AVENUE.

784 PARK AVENUE.

MALADAPTATION AS A FACTOR IN THE ETIOLOGY OF NEUROSIS

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THE definition of health is one that is not easy to give although in general it is fairly readily understood. It is a truism that the normal is a wide and varying standard and that the pathologic shades into the physiologic by imperceptible degrees. And yet broadly, the concepts of health can clearly be formulated. From the biologic standpoint, health means simply a more or less perfect adaptation to environment. We say an organism is adapted when its reactions to the external world are favorable to the continuance of physiologic functioning.

But adaptation must be made on the mental as well as on the physical plane for the soundness of mind and body. It is not a new theory that psychopathologists are holding out, that poor psychic adaptation is at the bottom of much of the neurosis we see, yet it is only recently that as much attention has been given to this phase of the subject as it has deserved.

The relation of body and mind is a problem as old as philosophy and perhaps as unsettled as ever, but that some relation exists every one knows. Mental pain or suffering, we are aware, if prolonged in any form makes its inroads on the body. The overwrought man failing in business eventually breaks under the strain of his worry; the grief-stricken one, who cannot reconcile himself to the loss of a relative, declines in health; the woman with a strong instinct for maternity often becomes a physical sufferer if deprived of motherhood; the surgeon, too, knows how much the chances for shock are increased in a patient who frets much about the approaching operation. In certain instances of intense or sudden emotional shock, death may result.

These phenomena are merely common observations in the daily life of us all, and they illustrate that a mind not at ease has within it power to produce physical suffering. We know that in most neurotics a constant anxiety is always with them, and they never attain the equipoise of the normal individual. It is a perpetual problem with them to adjust themselves to reality, as a result we see them going about entirely out of harmony with their surroundings. In short, there is always some conflict within their psychic sphere, always some mental pain in the form of phobias, obsessions, anxieties, hatreds, jealousies, feelings of inferior-

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ority or self insufficiency, that stamps them as being very abnormal temperamentally. In fact a study of these people convinces us that we are dealing more with anomalies in emotions and personalities than any other thing. They are persons who have made a failure in their adaptation to the conditions of civilized life and consequently break down under the excessive strain. The amount of stress and strain thrown on an individual to bear is largely determined by his temperament—that is by his attitudes toward life, his reactions toward situations, and the manner of meeting problems before him. To those whose temperaments have become stabilized, living becomes relatively easy with a minimum of nervous strain, but for those who have never reached this solidity, accommodation to even ordinary conditions of life is difficult and accompanied by much wear and tear on the nervous system.

The effect of maladaptation and psychic conflict upon the health of the individual was well shown by those suffering from 'shell shock' in the late war, for it is pretty well agreed now that war neuroses were psychic in origin and arose from the inability of the soldier to adjust himself to the strenuous conditions of war. It was just those soldiers, too, who were unable to sit easily in civilian life who broke first in the trenches though many of them had passed perfect physical examinations, and the nervous disturbances they suffered were in no way different from those of peace time. Sir James Purves Stewart, whose experience with shell shocked soldiers was very large says "There is no exclusive war neurosis." That is there is no neurosis in war which we do not see in civil life. Furthermore war neuroses are not confined to the combatants, they occur during war times in peaceful citizens, not only in those exposed to incidents of war such as aerial raids and other bombardments, but even in individuals far removed from such experiences that is among home relatives and friends of soldiers or in timorous conscripts who have never been anywhere near the fighting line.

If it be true that these unfortunate misfits are suffering with temperamental incompatibilities with environment the prophylaxis and treatment depends upon either changing the temperament or the environment. In children with whom this paper is largely concerned this will be much easier than in adults. Doubtless the nervous temperament is to a certain extent inherited but surely not as much as we formerly believed. It is, perhaps not so much the nervousness that is inherited as it is a sensitive nervous structure that reacts more intensely to situations than is normal. Biologists are giving more and more attention to the molding effects of environment rather than to the formerly over stressed importance of heredity. Innate mechanisms plus the working of environment are what eventually determine the character of any organism but in estimating the influence of heredity, we have usually been blinded by the early effects of environment. It is well known that man is very impressionable to his surroundings in his early years as

compared to his later ones, and the saying, "You can't teach an old dog new tricks," is figuratively true. When adult life is reached, temperament is largely fixed and changes slowly under any conditions. In early life it is different. In the words of Cameron, the young child is merely a mirror of his environment and reflects back every influence brought upon him. In his masterful essay on habit, William James says

"There is no part of the organism in which the reconstructive activity is so great during the whole period of life as it is in the ganglionic substance of the brain, and this nervous structure is peculiarly liable to modification during the early period of life in which the functional activity of the nervous system, and particularly the brain, is extraordinarily great and reconstructive processes proportionately active."

What is so clearly true of the nervous apparatus of animal life can scarcely be otherwise than true of that which administers to the automatic activity of the mind. The psychological principles of association, indeed, and the physiologic principles of nutrition simply express the universally admitted fact that any sequence of mental action which has been frequently repeated tends to perpetuate itself so that we find ourselves automatically prompted to think, feel, or do what we have been before accustomed to think, feel, or do under like circumstances without any consciously formed purpose or anticipation of results. The strength of early association is a fact so universally recognized that the expression of it has become proverbial.

In accordance with these principles then, it is but logical that the child will grow up exhibiting the same characteristics as parents with whom he was almost exclusively associated in the most impressionable years of his life. For up until the school age, little influence outside the home is ever encountered, and by that time the character and temperament has already taken a strong set, forming attitudes that will direct it through life. To use an old simile, the tender plant just emerging from the earth, may take only a slightly perceptible change of direction by impinging against the clod, but the new set determines the direction in which it will grow in mature life when it has become a tree. The influence of the clod is strongly seen. So in childhood, the early home environment determines the mold to which one grows and can never be wholly effaced.

In neurotic children it is the rule to see the same tendencies in one or both parents and the effect of almost constant and exclusive association in this nervous environment at the time of life when temperament is taking its irrevocable set, is one that is lasting throughout life. On this subject the late J. J. Putman, formerly Professor of Nervous Diseases at Harvard, has this to say: "When parents and child exhibit the same symptoms, it can often be shown to have been the influence of the nervous ignorant mother driven by a fatal impulse to strive

toward reproducing herself in the child and the fatalistic impulse of the child to imitate the mother, rather than any hereditary tendency that brought the result to pass."

Thus it is, the environment in the home makes for habits of anxiety and irritability or for mental rest and quietude and so determines much the present and future health of the individual. In his volume on the nervous child Cameron says "The body of the child is molded and shaped by the environment in which it grows. It is the outstanding rapidity, which the mental processes develop that forms the distinguishing characteristic of the infancy of man. Were it not for this rapid growth of the cerebral functions the rearing of children would be a matter almost as simple and uneventful as the rearing of livestock, for most animal faults of environment must be very pronounced to do harm by producing mental unrest and irritability. Thus indeed some wild animal separated from its fellows and kept in captivity may sicken and waste though maintained and fed with every care. Yet if the whole conditions of life for the animal are not profoundly altered if the environment is natural or approximately natural, it is as a rule only necessary to care for its physical needs and we need not fear that the result will be spoiled by the effects of the mind on the body. With the child it is different airy nurseries big gardens, visits to the seaside, and every advantage that money can buy will not achieve success if the child's mind is not at rest, if his sleep is broken if his food is habitually refused or vomited, or if to leave him alone in the nursery a moment is to evoke a fit of passionate crying."

In children as in adults, nervous symptoms may be prominent although the physical surroundings of the patient may be all that could be desired. The unstable mind of the child is so sensitive that cerebral fatigue and irritability are produced by causes that seem extraordinarily trivial. In the simple life which a young child leads it is not always easy to perceive just where the cause of nervous overstrain may lie. But it is usually in the personality of the mother or nurse, in her conduct toward the child in the tone of her voice in her very word or action. The mental environment is created by the mother. There are many women who without any deep thought on the matter have the inborn knack of managing children they seem to understand them, and we say the children are always good in their keeping. But then there are others who are indeed lacking in this respect in their care children are quickly demoralized, sleeplessness, irritability fretfulness anorexia, and a host of other ills soon make their appearance.

It is through the enormous susceptibility to suggestion that a great part of the educational and temperamental development of the child transpires. In its essence the problem of managing children has largely to do with the regulation of the interplay between the adult mind and that of the receptive suggestible child. Nervous and apprehensive

parents, who are distressed when the child refuses to eat or sleep and who worry all day over possible sources of danger, are forced to watch their child acquire a reputation for nervousness which, as always, is passively accepted and consistently acted up to. As just pointed out, the disturbing and irritating element in the young child's environment is the restless intrusion of the adult mind. With an only child it is difficult to avoid this fault. His existence consists entirely of the pre-occupations of his parents with his welfare. He rapidly grows incapable of living without this stimulation and the constant society and attention of adults. He cannot be left alone and is yet unable to enjoy the excitement he craves. As a result he grows increasingly restless and irritable, dominating the whole household, till finally exhaustion produces the refusal of food, wakefulness, dyspepsia, and a whole train of other difficult symptoms.

In older children the line which separates fractiousness and naughtiness and restlessness from definite neuropathy begins to be more marked. The nature of the infant and young child taking its color from its surroundings is sensitive, mobile, and inconstant. With every year that passes, the normal child loses something of this impressionable and fluid quality. Increasing experience and intellectual development if tempered with discipline give the child a more and more unyielding surface to environment until finally it becomes set in the stability of mature age.

In the passage from early infancy upward, we can recognize a gradual approach to the conditions of adult life if things progress normally, but when at any stage we can perceive a lagging backward, a tendency to fixation in early phases of development, then we are sure that things are going amiss. Fractiousness, naughtiness, violent paroxysms of temper, uncontrollable weeping, morbid fears and inclinations should vanish away with the first years of life. If they persist into later childhood we shall see that in a large percentage of cases definite neuropathy is well under way. When we pause to examine these children we see as the fundamental feature clearly portrayed, the elements I am repeating so many times, marked sensitivity to all forms of stimuli with an incapacity to control emotional responses—typical reactions of the first period of life before the molding forces of discipline and the experiences of reality have had their play. Looking more carefully into their natures one observes that the emotional component of their being has so overgrown itself as to dominate their lives in spite of every effort at control. "Broadly speaking, there are two types of neurotic children," says Leonard Guthrie who has described them perhaps better than anyone else in his work on *The Functional Diseases of Children*, "the restrained and unrestrained type. In the latter there is supersensitivity and excessive reactions to all forms of stimuli. Their emotions are easily excited and they have little control over their outward display. Their feelings are strong for the moment but shallow and changing

some are extravagantly affectionate at one moment, brutally callous and indifferent the next, selfish beyond measure craving for sympathy, regarding themselves aggrieved if overy whim of the moment is not satisfied, goaded to fury by interference, and resentful of all discipline. They are high spirited and impulsive, but easily discouraged, now enthusiastic and castle building, and now crushed and abused worried by trifles, anticipating difficulties but making no effort to meet them. Often they are timid, sickle, untrustworthy, imaginative and superstitious. They are quick at learning but forgetful of facts, seldom capable of prolonged industry, hating drudgery, but working with feverish energy in fits and starts. They are speedily exhausted both bodily and mentally. They are continually seeking new forms of emotional and mental excitement, and unless these are provided for them, they become bored, morose and hypochondriac. They never seem to learn prudence or common sense and caution from experience and their actions are capricious and eccentric."

Of the restrained type he says: "As in the first there is supersensitive ness to all forms of stimuli, but the reactions are suppressed. If motions are strongly felt but the control over their outward display is equally strong. They are regarded as wanting in natural affection, but really yearn to be loved, they brood over slights and become gloomy, morose solitary in habits, introspective, and superstitious. They harbor various kinds of phobias. Their apparently stolid indifference to their surroundings is varied by sudden fits of ungovernable rage or weeping. Some are observant and intelligent but so reticent that they pass for being sullen or obstinate. This disposition with its characteristic suppression of all outward emotion is as exhausting as that of the other type, in which emotional excess is obvious, and it is associated with many similar complaints."

This, then is the picture of the neurotic child, always a prey to and driven by unbridled emotions never able to harmonize the internal mental life with external reality over the subject of psychic conflict and strain, and perpetually a sufferer from numerous functional disturbances. Many of the most troublesome disorders encountered in children are met in these patients. They are liable to repeated night terrors, somnambulism, headaches, migraines, various forms of tic and bad habits, phobias and obsessions cold extremities and poorness of circulation eczema urticaria and erythema in its varied forms cyclic vomiting and cyclic or postural albuminuria enuresis and henteric diarrhea alternating with constipation and mucous colitis. If rheumatic they are very prone to develop chorea severe out of all proportion to any cardiac or arthritic symptoms that may be present. At an early period of their lives they are usually branded as having weak hearts, weak lungs or weak digestions or tendencies to consumption, and are treated with the utmost deference and consideration in view of such

vague proclivities, until they become introspective, hypochondriac, neurasthenic, psychasthenic, or hysterical

These symptoms are so common that every physician is called daily to treat them, and in many instances are without any physical basis and, like functional disturbances of any nature, yield very poorly to medical treatment. It is well recognized, however, that physical causes are present as an important etiological factor in some cases. The so called postinfective neurosis of children is a common thing, and organic heart or kidney disease, severe nutritional disturbances, errors of internal secretion, visual defects and pathology in the nasopharynx, do sometimes produce rather marked nervous symptoms, but usually these things, if present at all, play only a subordinate rôle, and if attention is directed to them alone, disappointing results are the rule.

I cannot close better than quoting again from Cameron, the great master in the field of nervous children. He says "And so we come back to the point from which we started the nervous infant, restless, wriggling, and constantly crying! The nervous child, unstable, suggestible, passionate, and full of fears! The nervous schoolboy or schoolgirl prone to self-analysis, self-conscious, and easily exhausted! Refusal of food, refusal of sleep, negativism, irritability and violent fits of temper, vomiting, diarrhea, morbid flushing and blushing, habit spasms, phobias, all controlled not by reproof or by medicine, but by good management and a clear understanding of their nature."

The hygiene of the child's mind is as important as the hygiene of the child's body and both are studies proper for the doctor. Neuropathy and an unsound nervous organization are often enough legacies from the nervous disorders of childhood.

BENIGN OR FUNCTIONAL ALBUMINURIA IN CHILDREN

FURTHER STUDIES

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THE significance of albumin in the urine of apparently healthy children and young adults is still the subject of much discussion. Most of these cases are accidentally discovered in the routine examination of urine in schools, orphan asylums, dispensaries or office practice. This so-called benign albuminuria is not an uncommon finding in children occurring much more frequently than in adults. The literature on this subject has been summarized during the past ten years by Lanchner,¹ Calvin, Isaacs and Meyer, Ashburn,² Fishberg,³ Palmer,⁴ Diehl and McKimlay,⁵ Hellebrandt,⁶ Jamieson and Scott,⁷ and others.

The outstanding observations are that slight or moderate albuminuria is a fairly frequent occurrence in children, especially in those over six years of age. It becomes more frequent toward puberty and reaches a maximum incidence during adolescence, the period of greatest growth. The incidence appears to be higher in girls. Globulinuria is the type of proteinuria that predominates in these cases although serum albumin may occur alone even in benign proteinuria. The acetic acid body (cloud forms in cold urine after addition of a few drops of 5 per cent acetic acid) considered as mainly euglobulin is usually present.

In recent years physicians generally have accepted the fact that albuminuria in children may be and usually is benign and have refrained from unduly arousing anxiety in themselves or the parents of their patients abandoning the axiom that 'albuminuria is a sign of Bright's disease until proved otherwise'. Nevertheless it is not a symptom to be disregarded, as the diagnosis of physiologic albuminuria is never entirely satisfactory even in cases of children apparently in the best of health. Consequently studies concerning the etiology of the condition are still being pursued. A summary of these may be found in the aforementioned literature.

A factor which undoubtedly is the cause of a certain percentage of proteinuria especially in young male adults, but which is scarcely mentioned and seldom discussed in the literature, is the prostatic and seminal vesicle secretions leaking into the urethra and mixing with the urine. Belfield⁸ and Rolnick⁹ have pointed this out, but it has escaped general attention. They state "It is known that the normal semen con-

tains albuminoid bodies of two classes (1) globulins, which like serum albumin are coagulated by heat or nitric acid, and (2) other proteins, which are precipitated by nitric acid but not by heat. If normal semen is mixed with ten times its bulk of water and filtered and nitric acid is allowed to flow down the side of the test tube containing the filtrate, three phenomena usually appear: (1) a white coagulum of globulin at the bottom of the tube, like coagulated albumin in the urine of persons with chronic nephritis, (2) above this a clear fluid for 1 or 2 inches, and (3) still higher a diffuse white cloud of proteins, which disappears on gentle heating and reappears on cooling. This 'vesicular albuminuria' is easily mistaken for renal albuminuria. They often obtained a positive test for protein in the urine after massage of the vesicles, especially in chronic vesiculitis, even though the urine passed before the massage did not give a positive protein reaction. They conclude "the proteins secreted by the epididymis and seminal vesicles and passing thence into the bladder may be sufficient in amount to show a precipitate in the urine by heat and nitric acid, although urine obtained at the same time through ureteral catheters may not show any."

OBSERVATIONS ON SIXTY BOYS

In order to determine the importance of this factor in the so-called benign albuminurias of children the author undertook an investigation on fifty boys ranging in age from five to twelve years. The urines of these boys were examined on three successive mornings and evenings and found free of protein by the usual nitric acid and heat-and-acetic acid tests. The boys were then subjected to gentle manual prostatic and vesicular massage for from five to ten minutes. All the urine passed during the next three hours was examined. In none was a positive protein test obtained either by the addition of nitric or acetic acid to the cold or warmed urines. The same procedure was carried out on ten boys showing benign albuminuria. No increase of the amount of albumin was noted after the massage.

TABLE I
SUMMARY OF EXPERIMENT

NUMBER OF BOYS STUDIED	AGE RANGE IN YEARS	URINE EXAMINATION 3 SUCCESSIVE A M AND P M SPECIMEN BY HEAT AND ACETIC, AND NITRIC ACID TESTS	PROCEDURE	URINE PASSED WITHIN THE NEXT THREE HOURS
50	5-12	Negative for protein	Digital prostatic massage 5 to 10 minutes	Negative for protein
10	8-13	Trace to 2+ protein	Digital prostatic massage 5 to 10 minutes	Trace to 2+ protein. Same amount as before massage

SUMMARY AND CONCLUSIONS

The author believes that prostatic or vesicular protein secretions in boys before the age of puberty play no role in the high incidence of benign albuminuria in children. That this factor requires further study in male adolescents and young adults is obvious, and the hope is entertained that the degree to which vesicular albuminuria plays a rôle in the incidence of albuminuria in young adults will be determined by those who have the proper material available for study.

Although the significance of albuminuria in children and young adults still remains obscure, recent contributions are gradually elucidating some of the factors involved. The author after paying particular attention to this type of case for the past eight years feels as he did in 1926 that most of these albuminurias in otherwise healthy children are harmless, benign and relatively transient; that the condition should not be stressed either to the parent or patient as the "disease" often occurs only in the physician's test tube. Yet the physician cannot totally disregard this benign albuminuria. Every case should be under observation for a variable period until it is certain that no organic changes have occurred (such changes as indicated by the appearance of casts, hematuria, fixation of specific gravity and hypertension) and the albuminuria has subsided. Neither rest cures nor low protein diets should be prescribed. Other abnormalities such as malnutrition, defective posture and foci of infection if present, should be treated as usual.

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5111 KENDALL AVENUE.

THE USE OF COPPER AND IRON IN THE TREATMENT OF SECONDARY ANEMIA IN CHILDREN

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THE value of the administration of copper in conjunction with iron in the treatment of secondary anemia has been demonstrated in animals,¹⁻⁸ in children,⁹⁻¹² and in adults.¹³ But more observations are needed on the ratio of copper to iron, and also on the comparison of the effects of cupric and ferric compounds, and cuprous and ferrous compounds, because of the reports that the latter are more efficacious.^{14, 15, 16} Six children suffering from secondary anemia due to malnutrition or infections, whose hemoglobin varied from 40 to 74 per cent (average 58.5 per cent) on admission were treated. Three times daily they were given from 5 to 10 c.c. (according to their ages) of a solution containing 0.5 gm. of cupric sulphate and 10 gm. of ferric ammonium citrate per 100 c.c. of 25 per cent aromatic elixir solution (U.S.P.). Such a preparation can be prepared at a cost of less than twenty cents per pint. In this way, each patient received daily from 10 to 20 mg. of copper and from 250 to 500 mg. of iron, which is in agreement with the dosage of iron found to be optimal by Minot and Castle.¹⁷ Similar commercial preparations were considered, but the majority of these contained less than one third of these amounts of copper and iron, and the costs were many times higher. Different proportions of copper and iron were used at first in order to determine a palatable ratio. It was found that a proportion (of available copper to iron) higher than 1 to 25 produced nausea and vomiting in 20 per cent of the patients.

Six children whose secondary anemia was similar to that of the first group and whose hemoglobin on admission averaged 63 per cent were given cuprous and ferrous glutamate.* This material was made up in capsules each of which contained 30 mg. of cuprous glutamate and 750 mg. of ferrous glutamate. The dosage was three capsules daily, which provided the same amount of iron as 15 c.c. of the cupric and ferric compound. The ratio of available copper to iron was 1 to 34.

The hemoglobin content of these children was determined at intervals for an average of four weeks by the Sahli method and recorded on a

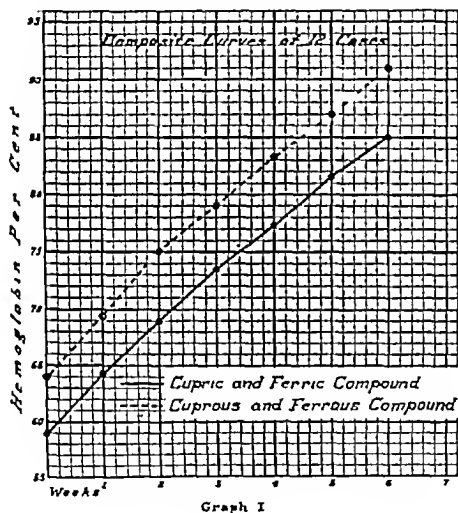
Read before the Section on Pediatrics of the Medical Society of the State of North Carolina at Raleigh, N. C. April 10, 1933.

From the Department of Pediatrics, Duke University School of Medicine and Duke Hospital, Durham, N. C.

*The cuprous and ferrous glutamate was kindly furnished to us for this purpose by the Calco Chemical Company.

percentage basis, 16 gm hemoglobin per 100 cc of blood being regarded as 100 per cent. While the children were in the hospital, examinations were made at least once a week but those observed in the dispensary had their examinations at longer intervals. Probably the curve of rising hemoglobin would have been sharper in its earlier stages, if determinations had been made at more frequent intervals.

In the children whose anemia was due to malnutrition the hemoglobin content increased rapidly while in those who had infections, the rise usually did not occur until the infection had subsided.^{18 19 20} As may be



seen in Graph I the children treated with the cupric and ferric compound, and those given the cuprous and ferrous compound showed the same rate of increase in hemoglobin content namely 4.6 per cent per week.

CONCLUSION

As far as can be judged from this small series observed for a short period of time, a ratio of copper to iron of 1 to 25 is palatable and does not cause nausea and a cupric and ferric compound is as efficacious in the treatment of secondary anemia in children as is a cuprous and ferrous compound.

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DIABETES MELLITUS IN CHILDREN

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SIXTY FIVE children with diabetes mellitus were admitted to the wards of the Children's Memorial Hospital during the period from April 1, 1921 to November 1, 1933. This number includes ten private patients and fifty five patients admitted through the Out Patient Department, where during the same period a total of 85,359 children were registered. Since November 1926 I have had the opportunity to observe and treat fifty two of these children.

Since in juvenile diabetes the pathologic changes in the pancreas are not readily demonstrable¹ and do not seem sufficient to account for the severe disturbances of metabolism, it seemed possible that a study of this disease in children in whom the course in untreated cases is very rapid, might throw some further light on the underlying, as well as the exciting causes of the disease.

In the survey of these cases, the incidence of the disease was studied in relation to age, sex and nationality. The effect of heredity as a causative factor and the influence of infection, trauma and carbohydrate overfeeding as exciting factors were noted in the fifty two patients. Several glucose tolerance curves showing the course of the disease over a period of years were plotted. A detailed analysis of the fatal cases was attempted.

AGE AT ONSET OF SYMPTOMS

The highest incidence of onset in this study is in the second and fifth years of life. It is possible that the high carbohydrate diet in the latter part of the first year is a contributing factor to the high incidence of appearance of symptoms in the second year although a history of heredity was noted in two such instances. A grandaunt of a twenty month-old boy had recently developed diabetes. A paternal uncle of an eleven month-old boy had recently developed diabetes at the age of thirty nine years. A small pancreas was reported at autopsy in this latter child.

Cambridge² suggests that the disease may develop from inherited defects in the pancreas, recessive in nature, "which prevent the development of the organism in a particular direction from keeping pace with the increasing demands of the growing body, and as the inherited factor probably differs in intensity, so the period of life at which the symptoms of diabetes appear also varies." Trusen and Walenta³ found

that the greatest number of cases appeared in the sixth year and attributed this to the greater exposure of the child to infection on entering school. Priesel and Wagner⁷ reported a large number of cases appearing in the sixth year, but a still larger number at puberty. White⁴ observed a marked increase in the disease at puberty, and attached much importance to the overheight and functional overstrain of the organism at this period as etiological factors.

TABLE I
AGE AT ONSET OF SYMPTOMS OF DIABETES MELLITUS IN 65 CHILDREN

AGE IN YEARS	NUMBER OF CASES
0-1	2
1-2	11
2-3	7
3-4	0
4-5	8
5-6	5
6-7	4
7-8	4
8-9	7
9-10	5
10-11	3
11-12	4
12-13	5

SEX

Of the sixty-five cases, forty-one, or 63 per cent, were males and twenty-four, or 37 per cent, were females. The preponderance of boys over girls is greater than that usually reported. In Joslin's² group of 395 children, 52 per cent were males and in his 2,800 adult cases, 57 per cent were of this sex.

NATIONALITY

As shown in Table II, the incidence of the disease was highest in northern Europeans especially those of Scandinavian extraction. This may be explained in part by the author's observation that the usual Scandinavian diet contains a high proportion of carbohydrates. However, this high incidence may be due to the relatively larger proportion of northern Europeans residing within a reasonably short distance from the hospital. The markedly low incidence of diabetes among the Jewish race in this group may be due to the relatively small attendance of Jewish children at this clinic. Furthermore, diabetes in the Jew tends to be inherited as a dominant characteristic and less frequently develops in the very young child. The difference in the statistics of Priesel and Wagner⁷ who reported 30.6 per cent Jews among 121 patients and those of Joslin² who reported only 6.1 per cent Jews in a large series probably lies in the difference of the Jewish populations of Vienna and Boston.

TABLE II
NATIONALITY OF 47 PATIENTS STUDIED

NATIONALITY	NUMBER OF CASES
Scandinavian	14
German	2
Irish	6
Polish	6
French	2 $\frac{1}{2}$
Italian	2
Scotch	1
Dutch	1
Hungarian	2
Bohemian	1
Hebrew	1
Austrian	1
English	1
Negro	0

HEREDITY

A careful history of diabetes in the family and relatives was elicited. In eleven or 21 per cent of the fifty-two children a history of the disease in relatives, with two instances in an older brother was obtained. Diabetes developed in a father five years after the appearance of the disease in a ten-year-old daughter. The incidence of a history of diabetes in the family or other relatives varies greatly in the reports from different clinics—in some instances where the patients have been followed for several years it reaches almost 50 per cent.⁷

Buchanan⁸ in a clinical study felt that diabetes was not transmitted as a Mendelian characteristic. He studied the descendants from the marriage of a diabetic and a nondiabetic individual through the second and third generations in forty-four families. Cammidge² concluded from clinical studies and experiments with interbreeding of races of mice and of other animals with normal and high blood sugars that diabetes is transmitted as a recessive characteristic but can also be inherited as a dominant one. In the recessive type the disease occurs early in life, is usually severe and progressive and frequently self-exterminative while in the dominant type it usually appears after 40 years, is almost invariably mild and may persist for years without causing serious symptoms. In both types, the disease manifests a tendency to develop earlier in successive generations.

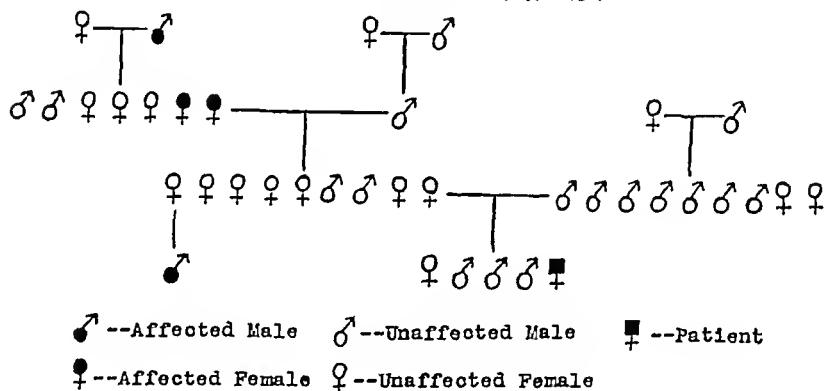
D. B., a girl with onset of symptoms at twelve years and two months, had a maternal grandmother and a maternal grandaunt with diabetes (the former died at the age of forty-one years after six or seven years of the disease) and a maternal great grandfather who died of diabetes. A male maternal first cousin has recently developed diabetes at the age of fourteen years. The girl's mother, aged fifty-five years, has no symptoms of diabetes and the paternal history is free of the disease. If we accept Mendel's Law in the inheritance of dia-

betes, then the father must have been a hybrid character since the mother evidently was a hybrid carrier capable of transmitting the disease. This family tree would seem to illustrate the recessive type. The course of the disease in this child was mild for about three months and then became quite severe following an upper respiratory infection. She died at the age of thirteen years, ten months after the onset of symptoms.

Wright⁹ demonstrated cases of dominant and recessive hereditary types. Curtis¹⁰ from a study of diabetic twins felt that the major feature of the disease pointed to a hereditary background or to some congenital liability to functional failure of the islands of Langerhans. In accord with this view, Priesel and Wagner⁶ believe that the exciting factors which precipitate diabetes do so because of a preexisting anlage which

TABLE III

HEREDITARY AND FAMILIAL HISTORY OF D. B.



is often manifested by some external stigmata of degeneration. Colwell and Bright¹¹ suggest as a result of experiments on the effect of epinephrin on glucose oxidation "that ordinary diabetes mellitus is the result of a functional disorder of the pancreas, which is dependent on a disease of the sympathetic nervous system, and that continuous excessive secretion of epinephrin may be an important intermediate factor in this mechanism." Of interest in this connection is the recent report of the discovery by Medvedeva¹² of a hypoglycemic hormone of the cortex of the adrenal gland. Houssay and Biasotti¹³ found that the blood sugar was not influenced greatly in pancreatectomized animals which had also been hypophysectomized, that insulin shock was more readily produced than in the normal animal, and later that glycosuria could be produced by injection of an anterior lobe hormone. They concluded that the anterior lobe hormone acts directly on the tissues, stimulating the production of sugar and perhaps retarding its consumption when insulin is lacking.

EXCITING FACTORS

Carbohydrate overfeeding, trauma, and infections have been frequently emphasized as exciting factors in precipitating diabetes. Overfeeding may have been a factor in the case of a ten year-old girl whose diet had consisted of a combination drug and grocery store fare of few cooked meats and many malted milks. She complained of upper abdominal pain—possibly cholecystitis—for one year prior to onset of diabetes. Her father has since developed the disease five years after onset in the child. A boy of five years developed diabetes during the course of an acute otitis media. He had consumed four or five glasses of malted milk each day for several months in order to consume a quart of milk daily. The father of an eight and-one-half year old boy had died from a carbuncle and the child had been placed in an orphanage where he had a high starch diet for eighteen months. He had many attacks of bronchitis during this period. His course is shown on Chart 3. A boy with onset of diabetes at twenty three months had had an inadequate diet of condensed milk, potatoes and gravy to which bacon was added at twenty-one months. A five year-old boy born in Italy who had had a mild diabetes for one year stuffed his pockets with sweetened figs and drank the customary glass of wine with each meal.

In two instances, trauma preceded the onset of diabetic symptoms. A four year-old girl fractured her right radius one month before onset of symptoms. A foreign body was removed from the esophagus of a two and three-quarter year old girl, one year prior to onset of symptoms. The foreign body had been present for several weeks with a resulting anorexia which had persisted up to the development of diabetes and for many weeks thereafter. She contracted a severe cold about a month before onset of symptoms.

In four other children, infection may have been an exciting factor. A six and three-quarter year-old girl developed symptoms of diabetes two months after the onset of a severe attack of tonsillitis from which she had not yet completely recovered. Her mother had a thyroid adenoma, had had two miscarriages and while pregnant with this child had pernicious vomiting. Measles preceded the onset of symptoms less than two months in a two-year-old boy. A peritonsillar abscess ruptured spontaneously in an eleven and three-quarter year-old girl one month prior to onset of symptoms. Varicella preceded the onset of symptoms less than one month in a two and-one-half year-old girl. In two instances the disease was discovered during the course of an acute otitis media. Acute purulent otitis media was present in three other children upon initial admission to the hospital although symptoms of diabetes had been present earlier. Toverud¹⁴ found a recent history of infection in 26 per cent of his cases and felt infection was of greater importance than heredity in the causation of diabetes in children. Wil-

hams and Dick¹⁴ noted frequent glycosuria and hyperglycemia during the course of acute infectious diseases

Metabolic disturbances are frequently found in the family history and occasionally in the child's history. Two children developed symptoms of diabetes at one and one-half and two and one-fourth years shortly after the subsidence of a moderately severe eczema. A boy, five and three-quarter years old, who had been breast fed until eighteen months of age and who is said to have been a "skeleton," had both parents with thyrotoxicosis. An older brother has recently developed diabetes. Other instances of asthma and thyroid disturbances in the family histories were found.

It is difficult to draw conclusions from the above as to importance of carbohydrate overfeeding, trauma, infection, and metabolic disturbances in the production of diabetes. Prolonged overfeeding with carbohydrates in several instances, the presence of infection within two months of the onset of symptoms of diabetes in three instances, and concomitant with onset of symptoms in two cases suggests a close relationship between these factors and the onset of the disease.

TOLERANCE

In the past, juvenile diabetes was considered a progressively deteriorating disease ultimately approaching a total diabetes. With the discovery of insulin hope was aroused that this specter would disappear, and indeed many children showing great gains in tolerance with its use have been reported. Robertson¹⁰ recently has stated that diabetes is a progressive disease tending to approach totality. He calculated, in a large group of collected cases, the ratio of potential carbohydrate in the diet to the insulin required to keep the urine sugar-free. He calls this the C/I ratio and found, using Woodvatt's¹¹ determination, that 1 unit of insulin has the power to burn $1\frac{1}{2}$ gm. of glucose and that the glucose tolerance tended to fall to a level of 1.5 or absolute diabetes.

In my series, in which the diets were higher in carbohydrates with a ratio of fatty acid to glucose of 1.1, only a few of the cases fell below 3, calculated according to Robertson's method. Possibly a longer period of observation might show a lower figure.

Collens and Graetz¹² found the glucose insulin ratio of particular value in indicating the course of the disease. They determined this ratio by dividing the amount of glucose utilized by the amount of insulin required to keep the urine sugar-free. I have found the determination of glucose tolerance helpful in prognosis and management of the individual cases. In determining the tolerance, 1 unit of insulin was considered sufficient to burn $1\frac{1}{4}$ gm. of glucose, the number of units of insulin administered was multiplied by $1\frac{1}{4}$ and the product in grams subtracted from the total glucose of the diet, the remainder being the amount of glucose metabolized where the urine was sugar-

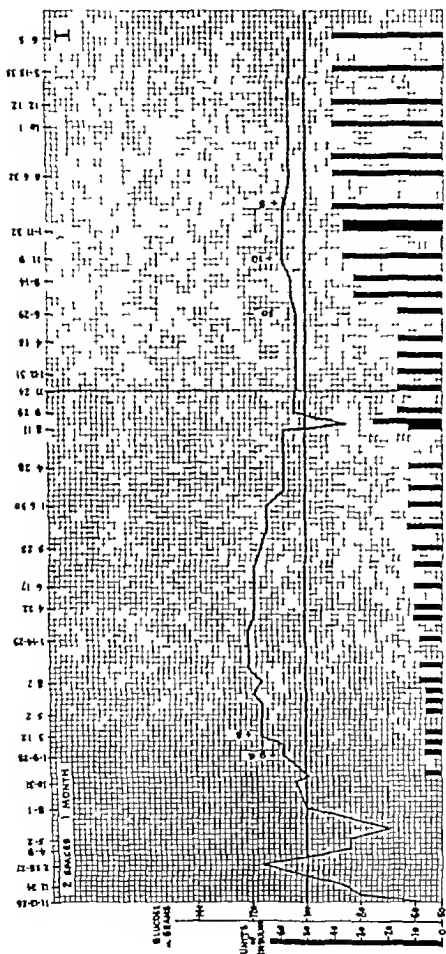


Chart 1. K. V. Solid line represents the total available glucose of the diet in grams. Plus or minus "G" denotes the addition or subtraction of glucose from the diet. The drop in the tolerance curve on February 8, 1934 was due to pericardial upper respiratory infections and that of August 11, 1933 to a severe influenza.

free The usual tolerance curve in this series shows a rapid rise in the first two months of insulin treatment, a slight drop at six months, and a tendency thereafter to remain above 100 gm

Marked permanent losses of tolerance were noted in one case after an attack of scarlet fever complicated in the second week by suppurative appendicitis and peritonitis, and in a case of protracted bronchitis Great temporary losses of tolerance were seen in two cases of lung abscess with empyema

The charts show the fluctuations of the glucose tolerance under insulin management, the effect of intercurrent disease, and the effect of dietary indiscretions in this series

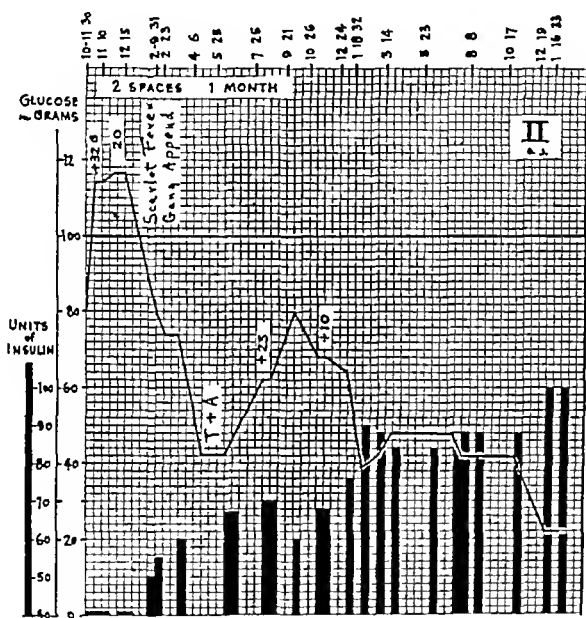


Chart 2

Chart 1 shows the fluctuation of the glucose tolerance during six and one-half years of treatment. No insulin was administered during the first year, the fluctuations were marked because of repeated upper respiratory infections. The drop on August 11, 1930, was due to severe diarrhea.

Chart 2 illustrates the damaging effects of scarlet fever and peritonitis on the tolerance, with improvement after tonsillectomy. There is a gradual but continuous fall in the curve due in part to the economic stringencies during the latter part of 1931 and 1932. This case tends to approach total diabetes.

Chart 3 illustrates a mild case of diabetes in a boy now twelve years old. There is a marked drop in tolerance with the development of a

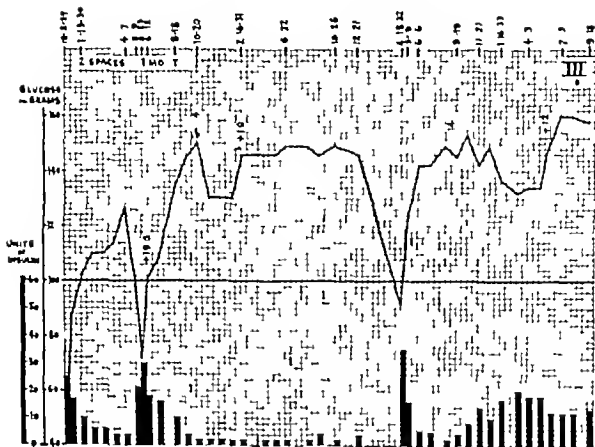


Chart 3

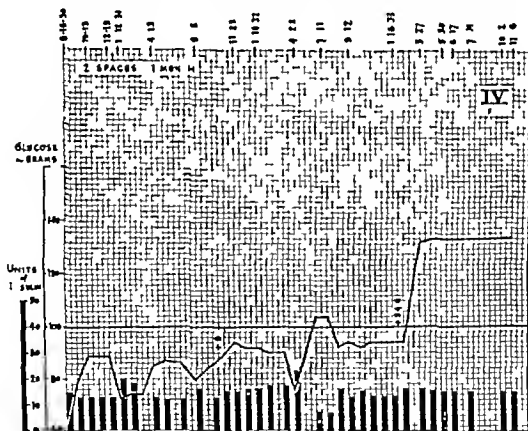


Chart 4

lung abscess with empyema which was preceded by a mild attack of scarlet fever following tonsillectomy, the second sharp drop in the tolerance was due to a voluntary reduction of the diet, and the third sharp drop to a break in routine care at home. Prompt rise in tolerance followed increased diet and insulin.

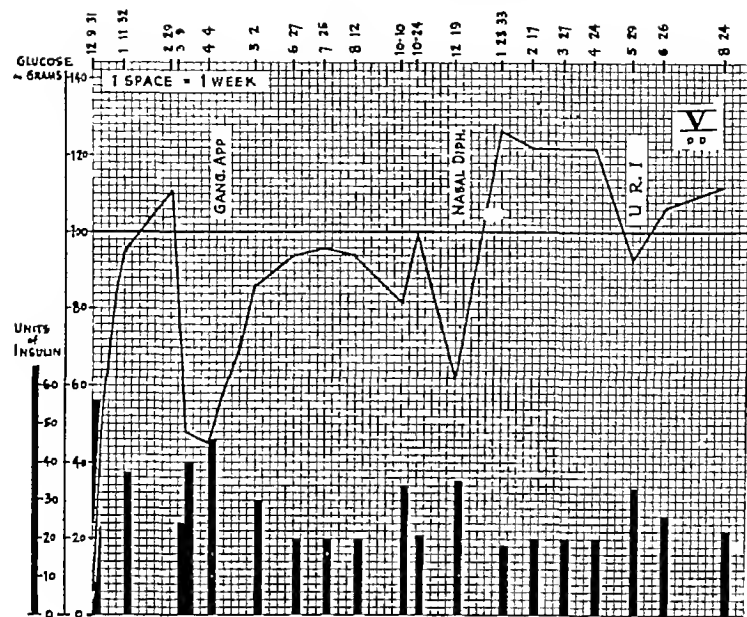


Chart 5

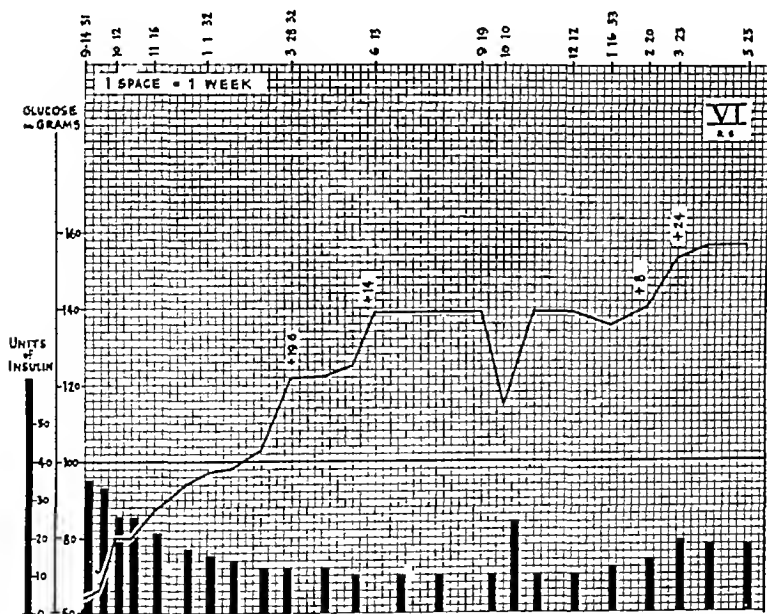


Chart 6

Chart 4 shows little fluctuation of tolerance over a period of two years in a boy whose age at onset was one and three quarter years. After the addition of a large amount of carbohydrate to the diet during the past year, there has apparently been an amazing increase in the tolerance

Chart 5 shows the depressant effects of gangrenous appendicitis and the lesser effects of nasal diphtheria in a four year-old boy. Diabetes had been present for two years, under haphazard control for one year.

Chart 6 shows the curve of a mild case of diabetes in a four and one fourth year-old boy whose symptoms were first noted two weeks previously. Tolerance was lowered temporarily in November, 1932, because of an upper respiratory infection.

Chart 7 illustrates a very mild case of diabetes in a five year-old girl with a remarkable return of tolerance.

The case illustrated in Chart 2 tends to approach total diabetes. Children who have not followed a proper diabetic regime are apt to

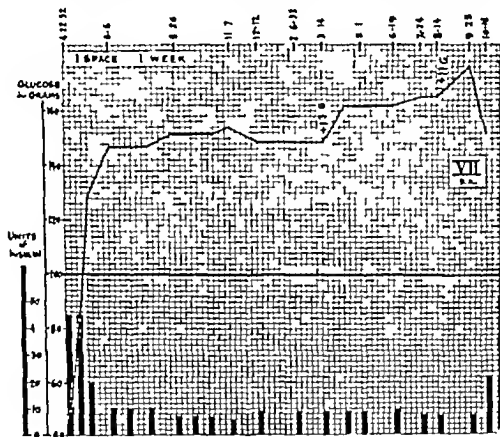


Chart 7

approach totality. It is often impossible to chart their progress since the urine is rarely sugar free over long periods. In the cases where the regime is poorly controlled and in the severest cases xanthosis^{19, 20} is a prominent feature.

MORTALITY

When the older literature prior to the discovery of insulin is studied, one is impressed with the hopeless outlook in juvenile diabetes. Fowler²¹ in 1892 said: "A peculiarity presented in children is the rapidly fatal course. No recoveries have been reported. In fact the disease is here very rapidly fatal. So rare is diabetes in childhood and infancy that few of the textbooks devoted to pediatrics mention it at all." In 1872 Senator²² said that the prognosis was hopeless and the treatment use

less Osler²³ stated in 1917 that he personally had not known of a case of recovery in a child. In his book of the same year, Holt²⁴ wrote that in few diseases has the prognosis been so bad as in diabetes in children, but that the outlook was not so immediately dark as it had been because of the recent methods of treatment, especially that recommended and elaborated by Allen. Statistics from Joslin's large series and from the Mayo Clinic showed a mortality of two-thirds of their cases in the eight years and three years, respectively, just preceding the discovery of insulin.

A study of the recent literature changes the picture completely. Joslin and White²⁵ in 1928 gave a mortality rate of 1 per cent per year for 303 patients over a period of twenty-two months. Allan and Wilder²⁶ report a mortality rate of 1.3 per cent for that year. Both Joslin and Wilder report a mortality rate around 9 per cent and stress the fact that the well-educated diabetic rarely dies of diabetes. Priesel and Wagner found less than 1 per cent mortality in 121 cases, while Trusen and Walenta²⁷ report a mortality rate of almost 50 per cent. A great portion of their fatal cases resided in rural districts where it was not possible to manage the complications promptly. Toverud¹⁴ in Norway reported a 36 per cent mortality rate which he attributed to the inaccessibility of the clinic to the patients living among the fjords and other distant parts of that country.

Of our group of fifty-two children with onset between the ages of ten months and twelve and one-half years, who have been under observation from three months to six and one half years, there are forty-five living, two in whom contact was lost, and five dead. The analysis of the fatal cases follows:

D. B., a girl, after ten months of diabetes, was readmitted to the hospital in semicoma, maniacal, with a blood sugar of 0.533 gm per 100 cc of blood and plasma CO₂ of 13 volume per cent. The mother had been working out of the home on the day of the onset of this acute illness, which began with vomiting. The child had retained no food for 36 hours, and no insulin had been given during this time except for the 20 units given shortly before admission. There was little response either in the blood sugar or CO₂ to 90 units of insulin administered in the hospital. She expired twelve hours after admission with emesis and a pulse rate of 180 per minute. Death was attributed to heart failure as a result of ketosis. The death of this thirteen year old child was the result of imperfect understanding of the seriousness of the symptom of vomiting and indicated the necessity of education of at least two persons in the home, in addition to the patient, in the treatment of diabetes in children. Insufficient insulin was given this child.

Infection was a major factor in the death of two other children. W. W., a ten month old boy, was admitted with a diagnosis of acidosis. A marked glycosuria was discovered and controlled with insulin although the infant had many insulin reactions. After the fifth hospital day, diarrhea, bronchitis, and otitis appeared, and the child expired from acute intestinal intoxication on the twelfth day. The post mortem examination revealed a gross atrophy of the pancreas without any microscopic changes. A paternal uncle of this boy died at the age of thirty nine years of diabetes.

D. K., a girl, aged four and three-fourths years, was admitted to the hospital with a history of diabetes of one month's duration, a cough and a cold for one week, and acidotic poisoning for thirty-six hours. She had received 107 units of insulin but died twenty-six hours after admission with a diagnosis of right lower lobar pneumonia and coma. No chemical determinations of the blood had been made. At the autopsy extensive bronchopneumonia of both lower lobes, a tracheitis and hydropic and lymphocytic changes in the islands of Langerhans were revealed.

A. K., an extremely emaciated boy aged eight and one-fourth years, had had symptoms of diabetes for three months and acidosis for twenty-four hours. Upon admission the blood sugar was 0.460 gm per 100 c.c. and twelve hours later was 0.700 gm. During the seventeen hours in the hospital 140 units of insulin were administered. Cerebrospinal fluid postmortem was 0.187 gm per 100 c.c. No autopsy was permitted.

E. B., a boy aged eight and three-fourths years, was dying when admitted to the hospital. He had a history of diabetic symptoms for two weeks and acidosis for two days. The skin was cold and dry, pulse was imperceptible at the wrist, blood pressure was not measurable and the heart tones were very distant and irregular. During the three hours that he lived in the hospital, he was given 140 units of insulin, glucose intravenously, fluids subcutaneously, caffeine and heat. The urine contained 4.2 per cent glucose and the postmortem plasma CO₂ was 17 volume per cent. In these last two cases it seems possible that irreversible changes may have taken place before treatment was instituted.

Larger doses of insulin administered early in the disease should have influenced the outcome favorably in at least two of the fatal cases.

From the above findings it should be emphasized that any change in the condition of the patient should be promptly reported to the hospital or the physician, that continuous and unremitting education in the use of insulin and diet is imperative and that patients with intercurrent infections should be under close medical observation.

SUMMARY

- 1 Sixty-five children with diabetes mellitus were studied to determine the age at onset of symptoms, the sex and the nationality. Fifty-two of these children were treated and observed for periods varying from three months to six and one-half years.

- 2 The incidence of onset was high in the fifth and ninth years but highest in the second year of life.

- 3 Sixty-three per cent were males.

- 4 Scandinavian nationalities predominated.

- 5 Eleven patients or 21 per cent had a history of diabetes in an ancestor or immediate family. Heredity seemed to be an important factor in the development of the disease.

- 6 Infection and overfeeding were important causes in precipitating the onset of symptoms. Serious infection was present at the onset in many instances.

- 7 The tolerance for glucose under treatment tended to remain above 100 gm unless severe infection or prolonged dietary indiscretions occurred. Tolerance did not fall in the cases that were well controlled.

8 Five children died of diabetic coma in the hospital. Only one of this number had previously been treated in the wards of the hospital.

Invaluable assistance was given me by the Social Service Department and the Dietetic Service of the Hospital.

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BACILLUS ENTERITIDIS MENINGITIS IN AN INFANT OF FIFTEEN MONTHS

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IN 1930 Lanch and Shelburne¹ reviewed the cases of meningitis caused by bacilli of the paratyphoid group. Despite the numerous reports on record, they accepted only fifteen cases in which identification of the organisms was based on indisputable cultural or serologic evidence. They added a sixteenth case due to the *Bacillus enteritidis* of Gartner and concluded that meningitis due to bacilli of this group is a serious condition, usually fatal, and should be suspected whenever gram negative motile rods are found in the cerebrospinal fluid.

Cooko and Bell² emphasized the fact that meningeal infection by organisms of this group is sharply limited to early infancy. The majority of the patients noted by other observers are under one year of age. As an explanation of the age incidence they suggest three factors: (1) the greater permeability of the intestinal mucosa in early infancy; (2) decreased resistance of young infants to bacterial infection associated with defective antibody formation; and (3) the influence of digestive disturbances and malnutrition on the above mentioned factors.

In a recent review of 705 cases of meningitis occurring in children, Fothergill and Sweet³ stated that organisms of the colon group caused nine of the cases. Eight of these patients were under five weeks of age. A bacteremia was almost universally present. In the majority of cases there was a relatively high percentage of mononuclear cells in the spinal fluid compared to other types of purulent meningitis.

The variable symptomatology of infection with *Bacillus enteritidis* in older individuals is well illustrated in the case reported by Mc Nee.⁴ His twenty five year-old male patient presented the picture of influenza complicated with pneumo and acute hemorrhagic nephritis. No diarrheal symptoms occurred. The pus expressed from the bronchi at autopsy revealed an almost pure culture of *Bacillus enteritidis* as did a culture from the spleen. Cerebral edema was present but there was no evidence of purulent meningitis.

One hundred consecutive cases of meningitis observed from 1927 to 1931 at the Los Angeles Children's Hospital were reviewed and classified as shown in Table I.

TABLE I
DISTRIBUTION OF TYPES OF MENINGITIS

TYPE OF MENINGITIS	AGE LIMITS	NUMBER OF CASES
<i>B. tuberculosis</i>	6 mo 9 yr	52
Meningococcus	2 mo 7 yr	12
Streptococcus (Alpha type)	1 mo 6 yr	11
<i>B. influenzae</i>	1 yr 4 yr	7
Streptococcus (Beta type)	2 yr 10 yr	6
Pneumococcus	2 mo 2 yr	4
Streptococcus (not typed)	2 mo 8 yr	3
Streptococcus mucosus	7 yr	1
Staphylococcus (not typed)	2 days	1
<i>B. coli communis</i>	5 mo	1
<i>B. enteritidis</i>	15 mo	1
Syphilitic	1 yr	1

In Table I only those cases of tuberculous meningitis are included in which the organism was demonstrated in smears from the spinal fluid or in which conclusive gross microscopic evidence was present at autopsy. In the other nontuberculous cases the organisms were obtained from spinal fluid cultures during life with the exception of a few instances in which the culture was obtained from the exudate at autopsy. The large number of tuberculosis cases was partly dependent on the large Mexican population in which the disease is particularly prevalent. The relatively small number of meningococcus cases was due to the absence of this disease in epidemic form at the time these cases were observed. Mortality figures in the meningococcus cases are not available, because of the transfer of these patients to the Contagious Division of the Los Angeles General Hospital as soon as the diagnosis was established. Mortality in the remainder of the series was universal, with the single exception of the one syphilitic case.

The one case in this series caused by *Bacillus enteritidis* will be reported in detail.

REPORT OF CASE

History—L. P., a white female, fifteen months old, entered the hospital on May 31, 1931. Birth and previous history were not unusual. Both parents and an older brother were living and well. The patient had been well until two weeks before when a "head cold" associated with several loose stools daily was noted. Fever, vomiting, and listlessness developed. Three days following the onset of illness, there occurred a general convulsion of one and one half hours' duration. The child became progressively stuporous, and convulsive seizures were repeated on three occasions.

Physical Examination—The child was dehydrated and poorly nourished, weighing seventeen pounds. She was stuporous and aroused with difficulty. Marked neck rigidity was present, occasional purposeless fluttering movements of the hands and slight weakness of the left arm and leg, were noted. The pharynx was inflamed. No other abnormalities were observed.

Laboratory Data—The spinal fluid was cloudy and under increased pressure. Cell counts on various occasions ranged from 500 to 6500 cells per cubic milli.

meter, 95 per cent of which were pus cells. Blood examination showed 78 per cent hemoglobin (Dare) and 2,660,000 erythrocytes. Leucocytes numbered 21,000. A differential count showed polymorphonuclears 86 per cent, lymphocytes 11 per cent, mononuclears 3 per cent. Urine examination was negative except for a faint trace of albumin. Spinal fluid and blood cultures produced *B. enteritidis* (Gärtner) which was confirmed by cultural and serologic study.

Bacteriological Diagnosis.—Morphology and Staining. Direct smears from the purulent cerebro spinal fluid stained with Gram's method revealed numerous cells and gram-negative nonsporiferous rods mostly extracellular. The differential count was 95 per cent polymorphonuclear cell and 5 per cent lymphocytes. The bacilli proved to be actively motile when some of the fluid was placed on a hanging drop slide.

Cultural Characteristics. The organisms in the spinal fluid grew abundantly in veal broth, on blood agar plates, on lactose-yeast methylene blue agar plates, on bacteronutrient agar and on heart infusion agar slants. The rods measured from 1.60 to 1.81 microns in length and 0.375 micron in width. These measurements were taken after the organisms had been transplanted several times. The surface colonies measured from 1 to 2 mm in diameter. The colonies were finely granular in structure although they had a smooth appearance. The edges of the colonies were thin while the centers were somewhat dome shaped. There was no hemolysis produced on blood agar plates. In veal broth a pellicle was formed after seventy-two hours of incubation. On veal blood agar the growth was slightly gray in color, on yeast methylene blue agar plates the colonies were faintly pink, and on bacteronutrient agar and heart infusion media the growth was yellow in color and buttery in consistency. Cultures from the spinal fluid obtained at the second and third lumbar punctures produced the same organisms.

A blood culture taken June 6, 1931, produced organisms identical with those found in the spinal fluid after 48 hours incubation.

Biochemical Reactions.—The organisms produced in culture from the spinal fluid and blood formed acid and gas in a 1 per cent carbohydrate medium of dextrose, mannite and maltose. Fermentation was not produced in lactose or in saccharose. Indol was negative.

Serologic Reactions.—Technic of Agglutination Tests. Typhoid para A and para B antiserums and enteritidis antiserum were used in the tests.

TABLE II

RESULTS OF AGGLUTINATION TESTS WITH ORGANISM FROM SPINAL FLUID ANTISERUM ORGANISM PRODUCED IN SPINAL FLUID

	DILUTIONS OF ANTISERUM										
Antiserum	1 20	40	80	160	320	640	1 280	2560	5 120	10,240	20 480
Typhoid	+	+	+	-	-	-	-	-	-	-	-
Para A	-	-	-	-	-	-	-	-	-	-	-
Para B	+	+	+	+	-	-	-	-	-	-	-
Enteritidis	+	+	+	+	+	+	+	+	+	-	-

The antigen was made by washing with sterile normal saline nutrient agar slants of 24 hour cultures from the spinal fluid and blood of the patient. Three drops of 10 per cent formalin was added to the suspension to inhibit growth. One tenth of one cubic centimeter of each of the antiserums was used. After the agglutination tests were prepared they were shaken well and incubated overnight at 37.5° F. The next morning the tests were placed in the ice box for half an hour before reading.

The typhoid, para A and para B, antiserums used in the tests were purchased from Parke Davis & Company. The enteritidis antiserum was obtained from the Los Angeles County Health Department.

TABLE III

RESULTS OF AGGUTINATION TESTS WITH ORGANISMS OBTAINED BY BLOOD CULTURE
ANTIGEN ORGANISM PRODUCED IN BLOOD CULTURE

Antiserum	DILUTIONS OF ANTISERUMS										
	1 20	40	80	160	320	640	1,280	2,560	5,120	10,240	20,480
Typhoid	+	+	+	-	-	-					
Para A	-	-	-	-	-	-					
Para B	+	+	+	-	-						
Enteritidis	+	+	+	+	+	+	+	+	+	+	-

After the results shown in Table III were obtained, an agglutination test was made using blood serum from the patient, with an antigen made from a known pure culture of *Bacillus enteritidis*

TABLE IV

RESULTS OF AGGLUTINATION TESTS WITH PATIENT'S BLOOD SERUM ANTIGEN OF
KNOWN PURE CULTURE OF *B. Enteritidis*

	DILUTION OF SERUM									
Serum	1 20	40	80	160	320	640	1,280	2,560	5,120	10,240
Blood serum from patient	+	+	+	+	+	+	+	+	-	-

Because *Bacillus enteritidis* is so rarely found in spinal fluid, a culture was sent to Dr Karl F Meyer of the University of California. He reported the organism to be biochemically and serologically typical *Bacillus enteritidis* (Gartner)

Clinical Course—Fever was persistent and variable, ranging from 101° F to 105° F. No diarrhea or abnormal stools were noted. Convulsions were frequent, and the child became progressively weaker until death occurred on June 13, 1931, approximately one month after the onset. Therapy was limited to frequent spinal drainage by lumbar puncture, sedatives, and feeding by gavage.

Autopsy—Dr C M Hyland performed the examination on the day following death. The brain was swollen, congested, and extensively covered by a purulent exudate. The colon showed occasional small ulcerations of the mucosa. The solitary follicles and mesenteric lymph glands were hyperplastic. The remainder of the intestinal tract was negative. An exudate found in the left mastoid antrum, unsuspected clinically, yielded *Bacillus enteritidis* on culture. Culture from the bowel at autopsy revealed *Bacillus coli communis*.

COMMENT

Thorough study of the organism by cultural and serologic methods leaves no doubt as to the correct classification of the offending organism in this patient. The colitis found at autopsy, with the history of diarrhea preceding the onset of meningeal symptoms, suggests that the portal of entry of infection was the intestinal mucosa. The positive blood culture warrants the assumption that the meningeal involvement was metastatic through the blood stream. The finding of *Bacillus enteritidis* in the mastoid antrum is interesting since the tympanic membranes showed no evidence of middle ear infection during life.

SUMMARY

1 A case of meningitis caused by *Bacillus enteritidis* of Gärtner is reported in a fifteen month-old infant

2 The bacteriologic characteristics of the organism are discussed and the incidence of causative organisms is given in a series of 100 cases of meningitis in infants and children

To Dr. Phillip L. Rothman at whose suggestion this report was written, I wish to express appreciation of his continued help and interest. I am indebted to Miss Marion H. Anderson for her technical assistance in the bacteriologic study.

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CONVULSIONS IN CHILDREN

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A CONVULSION is a series of involuntary contractions of a group or several groups of muscles usually associated with a loss of consciousness. Initiated by various stimuli, convulsions originate in the motor area of the cortex, which transmits impulses through the brain to the anterior horn cells of the spinal cord and finally to the muscles. This symptom-complex, though occurring during all stages of life, is notoriously frequent in children, the frequency of which is inversely proportional to the age of the child. As the child grows older, the incidence of convulsions gradually decreases so that they are relatively infrequent after six years of life.

Morse¹ explains the frequency of infantile convulsions by the following two factors:

a In infancy there is a rapid growth of the brain, which makes it more vulnerable and irritable than its slower growing neighbors.

b The higher cerebral centers, inhibitory in action, are imperfectly developed in infancy and childhood and are thus less able to restrain discharges from lower centers than when perfect development occurs.

That heredity undoubtedly plays some part in the selective action in the development of convulsions offers an explanation for the absence of this symptom-complex in some children and its presence in others. Children born of neurotic parents have a greater tendency to suffer from convulsive attacks than children who have a more stable family background.

The exciting causes of convulsions are five in number, namely: toxic, organic, epileptic, reflex, and metabolic.

1 Toxic —

a The onset of acute infectious diseases is often ushered in by convulsions. This usually occurs after the first three years of life.

b Auto-intoxication is a very frequent causative factor, especially in children under four years of age.

c Acute disease of the nervous system causes the severest type of convulsions. If convulsions persist in spite of symptomatic treatment, a diagnostic spinal puncture should be made.

d Toxic convulsions in the newborn, though relatively infrequent, are usually due to the presence of bacterial infections involving the skin, nasopharynx, or umbilicus. A more infrequent cause is the absorption of toxins through the circulation or milk of eclamptic mothers. Lead poisoning caused by a nipple shield or salves on the nipples of the mother is a possible cause. An enlarged thymus (classed as

toxic or reflex) is an infrequent factor. Syphilis is seldom a cause.

2. **Organic**—This is the most frequent cause of convulsions in the newborn and is usually manifested within the first month of life.

a. **Intracranial hemorrhage**—traumatic or due to asphyxia from a prolonged and difficult labor or associated with a hemorrhagic diathesis, is the most common cause. The convulsions may be either clonic or tonic, usually appearing within the first forty-eight hours of life. Between convulsions the patient is drowsy, refuses to nurse and has a feeble cry and a possible bulging of the fontanel. The spinal fluid shows gross blood or a xanthochromic fluid due to the destruction of the red blood cells. The absence of blood may indicate the presence of hemorrhage within the brain substance.

b. **Congenital anomalies** are infrequent causes.

3. **Idiopathic Epilepsy**—According to Boyer, a seizure to be truly epileptiform must be transient, must impair or cause loss of consciousness and must ultimately result in some change, however slight, in the personality of the patient. This type of convulsion is not accompanied by any visible pathologic features. It occurs most frequently between the ages of five and ten years.

4. **Reflex**—This factor is almost negligible, in spite of the large number of cases attributed to teething, worms, plumbism and foreign bodies in the ear or nose. Teething, at the most, will cause slight fever, nasopharyngitis, otitis media, morexism and some restlessness. An enlarged thymus which may be classed as either toxic or reflex is an infrequent cause.

5. **Metabolic**—Spasmophilin or tetany composes the metabolic group. It occurs most frequently in children between eight and thirty-six months of age. Its seasonal incidence is usually from May to June. The calcium content of the blood stream is usually below 7.5 mg, and often 5 mg, per 100 cc. of blood.

The attacks occur spontaneously when the calcium level is as low as 7 mg. per 100 cc. of blood.

Latent tetany, the calcium content of which is less than 8.5 mg., is made active when an added impetus is present as slight toxemias, constipation, etc.

The etiology of convulsions has been variously treated by many writers, most of whom make the general statement that the majority of convulsions in children are based on the presence of a latent tetany.

In forty-five cases of convulsions at Touro Infirmary personally observed or investigated during a five-year period, the frequency of latent tetany is not substantiated.

Of the forty-five cases, eighteen were diagnosed as auto-intoxication, three epilepsy, five tetany, one cerebrospinal injury, one acute tonsillitis, one syphilis, and sixteen as "convulsions" (no etiological diagnosis).

Calcium and phosphorus determinations permitted a diagnosis of tetany in five, or 11.1 per cent of these cases. Whaley,¹⁴ chemist at Touro Infirmary for the past ten years, states that he has observed only a minor connection between convulsions and latent tetany.

As shown by the clinical picture and laboratory findings in this series the illnesses were for the most part mild in nature. These are the minor disturbances which are usually classed as the initiators of convulsions in cases of latent tetany.

In this series the calcium and phosphorus determinations are used as the criteria for the diagnosis of tetany although the writer realizes that occasionally true tetany occurs when the calcium is normal. In such cases there is a negative calcium balance in which more calcium is excreted than consumed. The importance of this is negligible because of its infrequency.

The normal calcium is assumed to be from 9 to 11 mg per 100 c.c. blood, this being based on the findings of Trumper and Cantarow² and Englebach.³ The normal phosphorus level in children is from 4 to 6 mg per 100 c.c. of blood. A calcium level of 8.5 mg or less is assumed as a basis for a diagnosis of tetany.

TABLE I

	NUMBER OF CASES	AVERAGE WBC	DIFFERENTIAL	AVERAGE TEMPERATURE	AVERAGE CALCIUM PHOSPHORUS	NUMBER POSITIVE WASSERMAN	AVERAGE AGE
1 Autointoxication	18	9,300	N60 L39 E1	102°	10.8 - 5.5	1	3 yr
2 Epilepsy	3	13,000	N61 L39	98°	11.1 - 5.3	0	5 yr
3 Tetany	5	10,000	N50 L48 E2	100°	7.7 - 3.8	0	2 yr
4 Cerebrospinal injury	1	15,000	N20 L80	98°	9.0 - 5.9	0	1½ mo
5 Acute tonsillitis	1	10,500	N70 L30	104°	11.1 - 5.2	0	8 mo
6 Convulsions	16	11,000	N53 L44 E3	102°	10.8 - 5.0	0	4½ yr
7 Syphilis	1	6,000	N69 L31	98°	10.0 - 4.9	1	4 yr

It is generally agreed that tetany is intimately associated with rickets. Consequently there is a tendency to diagnose as latent tetany most of the cases of convulsions in which there are signs of rickets.

Trumper and Cantarow² stress the fact that in the great majority of cases of rickets the serum calcium is within normal limits, the most prominent feature being a decrease in the level of the serum phosphate. In some instances, however, hypocalcemia occurs with manifestations of tetany.

Thus it is seen that while tetany is almost always associated with rickets rickets is infrequently associated with a low serum calcium and consequently tetany. On this basis the careless diagnosis of latent tetany based on the presence of rickets should be largely disregarded.

The damage sustained by the central nervous system as a result of convulsions is an important consideration in the light of clinical investigation. The time honored statement of many pediatricians and general practitioners that convulsions in children need not be considered seriously is unwarranted as there seems to be a relation between infantile convulsions and brain damage. But it must be borne in mind that the convulsion may be a symptom of a damaged nervous system or that the convulsion may have produced the damage.

In a series of 265 unselected cases with a history of infantile convulsions Thom⁴ found 29 per cent to be mentally deficient or epileptic. Still⁵ has pointed out that a comparatively small number of the individuals who have convulsions ever become epileptic. On the other hand Oiler⁶ found that 40 per cent of the cases under his observation which were diagnosed as epileptic gave a history of infantile convulsions.

General statistics compiled by neurologists show that 22 per cent of the cases of infantile convulsions later develop epilepsy as compared to the pediatricians' statistics showing 7 per cent.

One case observed by the writer stresses the prime importance of convulsions as related to brain damage and consequently the future welfare of the individual. This patient aged nine months had a severe attack of convulsions lasting about one hour, they were caused apparently by intestinal influenza. Twenty four hours later a spastic hemiplegia developed. After a week a partial return of activity occurred. At the present time six months have elapsed with a complete return to normality as far as can be observed. What the mental capacity in the future will be is yet to be determined. In this case an evident cerebral hemorrhage occurred. One can only surmise the frequency of minute unrecognizable hemorrhages sustained in convulsions. In the light of such findings infantile convulsions should be looked upon more seriously and a greater effort be made to prevent their occurrence during early life. In this way much epilepsy and mental deficiency will be prevented.

The treatment of convulsions should aim toward an early dissolution of the symptoms for the sake of the welfare of the child and the relief of the mental strain of the family. The first part of the treatment consists of a cold bath when fever is present or a warm bath when the temperature is normal. This is then followed by a high enema.

If relief is not obtained at once, the free use of drugs should be instituted, namely morphine, chloral hydrate, sodium bromide or luminal. Chloral hydrate in combination with the bromide is well tolerated by infants, no hesitancy should be felt in repeating the dose as often as necessary. The combination of chloral hydrate and bromide is best administered by rectum. If good results are not obtained in a short time the use of chloroform or ether is strongly recommended. The fact that the longer the convulsion lasts, the greater is the chance of damage to the nervous system, should be borne in mind.

Continuous muscle twitching not relieved by the above-mentioned treatment is an indication for a spinal puncture. This is of more diagnostic than therapeutic use.

As soon as possible, a purgative should be then given the patient. After complete relief of the symptoms, a diagnosis should be made and treatment instituted. Cases with doubtful etiology should be given the benefit of detailed laboratory investigation. In this way vague conditions may be relieved thus preventing future attacks of convulsions with subsequent mental deterioration and epilepsy.

CONCLUSIONS

- 1 The exciting causes of convulsions are five in number, namely toxic, organic, epileptic, reflex, and metabolic.
- 2 Latent tetany is an infrequent cause of convulsions.
- 3 In forty-five cases of convulsions tetany was present in five, or 11.1 per cent.
- 4 A diagnosis of tetany or latent tetany should be made only when there is less than 8.5 mg of calcium per 100 c.c. of blood.
- 5 Convulsions as a possible cause of epilepsy and mental deterioration are to be stressed.
- 6 Immediate control of convulsions is necessary to decrease the incidence of damage to the nervous system.

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ESOPHAGEAL VARIX

REPORT OF CASE IN A THREE AND ONE HALF YEAR OLD CHILD NOT DEPENDENT ON LIVER CIRRHOSIS

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RELATIVELY little space is devoted in textbooks on medicine and pediatrics to the discussion of varix of the esophagus as a clinical entity. Indeed, this subject is considered by Finkelstein¹ Peet² Holt³ Garrod, Batten, and Thursfield⁴ Tice⁵ and Blumer⁶ only indirectly as a possible source of bleeding in hepatic cirrhosis Banti's disease and related conditions. Abt⁷ Anders and Boston⁸ and Mathe⁹ dismiss the subject with the utmost brevity. Cecil¹⁰ is somewhat more generous allowing eleven lines to its consideration. The impression that it is especially infrequent during childhood finds confirmation by failure to discover a single reference to the subject in the pediatric textbooks from 1919 to 1932. The *Index Medicus* for 1931 contains only five references three in German and two in American literature. It is therefore deemed worth while to report the following case which may be regarded all the more unusual because it is not dependent for its genesis upon hepatic cirrhosis. A summary of the various aspects of this subject based upon a survey of the literature, is appended.

CASE REPORT

B. L., male three and one half years old was admitted to the Children's Hospital November 21, 1932 because of hemorrhage from the stomach and intestines. The family history was irrelevant.

The patient had had measles whooping cough and mumps during the second year of life. His general health had been considered good.

His present illness began when he was eighteen months old with nausea followed by vomiting of a large amount of bright red blood. Shortly thereafter tarry stools appeared. He seemed quite well for about one year when there was a recurrence of bleeding. Three months later he sustained a third hemorrhage. Bleeding again occurred on Thanksgiving Day. Recovery from hemorrhage usually took place in from two to seven days. Fever accompanied each hemorrhagic episode and occasionally reached 104° F. At times mild abdominal pains were noted. His stools were habitually frequent eight to ten times daily, and during the intervals between bleeding presented a normal appearance.

Physical examination disclosed a pale normally developed, poorly nourished cooperative child, who appeared moderately but not alarmingly ill. Respirations were somewhat embarrassed by obstruction incidental to an acute upper respiratory infection. The posterior cervical glands were slightly enlarged. The lungs were negative, the cardiac area was normal; heart rate increased and a systolic murmur was audible. The abdomen was distended, but not tender. The spleen

appeared enlarged, particularly upon percussion. The liver showed no hypertrophy. There was a large right inguinal hernia present. In other respects, the examination was negative.

The admission diagnosis made by the resident, Dr F. Bender, was varices in lower esophagus or possible ulcer of stomach.

Laboratory findings—The urine presented no abnormality. The stools were distinctly tarry. Hemoglobin, 58 per cent, erythrocytes, 3,300,000, leucocytes, 6,000. Polynuclears, 65 per cent, lymphocytes, 31 per cent, large mononuclears, 4 per cent, blood platelets, 180,000, bleeding time, fifteen seconds, and coagulation time, four minutes. Hemolysis began at 0.38 per cent and was complete at 0.32 per cent. The Wassermann test was negative.

Further observation—Nov. 28. The child was playful, ate with evident relish, sleep was undisturbed, temperature, 99° F. Nov. 29 to Dec. 2. Condition was unchanged, stools were black and semiliquid, numbering from three to four a day, temperature 100°-104° F., the rise was attributed to the upper respiratory infection, pulse from 120 to 130, and respirations from 24 to 30. Dec. 3. Appetite was good, he had three bowel movements containing well formed particles. He was given a transfusion of 120 cc. of uncitrated blood with no immediate unfavorable effects. Dec. 4. The patient slept undisturbed until 2 A.M. when he evacuated a large amount of bright red blood, followed in rapid sequence by three smaller bloody passages. His pulse became exceedingly rapid, almost imperceptible and respirations hurried and superficial. In spite of every effort to check the bleeding and bolster up a failing heart, the patient expired at 8 A.M.

Treatment had consisted of therapy for the upper respiratory infection, a bland diet, transfusion, and upon the advent of the fatal hemorrhage, of coagulants, glucose under the skin, and sedatives to control restlessness.

Autopsy, performed by Dr. E. I. Dobos, director of pathology, revealed the following conditions. The heart and lungs were negative. The esophagus was the seat of extremely large venous plexuses, with occasional hemorrhagic areas in its lower aspect. The cardiac orifice of the stomach showed several small mucosal ulcerations. The stomach contained one large clot estimated to represent 8 ounces of blood, and the intestines contained perhaps a like amount of clotted blood. No dilated veins were found in stomach or bowel, and these organs presented no pathology other than a striking anemia, which likewise characterized all the viscera. The spleen and liver were not enlarged.

DISCUSSION

The provisional diagnosis advanced by the admitting physician was varix of the esophagus or a gastric ulcer. Hemophilia and purpura were considered and readily excluded. Banti's disease was deemed unlikely because of a decided proneness to its occurrence in later childhood. Ulceration of a Meckel's diverticulum could not conceivably account for the hematemesis. Gaucher's disease was untenable because of a negative family history and absence of striking splenic enlargement. X-ray investigation was requested but deemed inadvisable by the roentgenologist because of bleeding. Esophagoscopy was contemplated upon subsidence of the respiratory infection.

HISTORICAL

Varicose dilatation of the esophagus was first observed by le Diberderi and Fauvel in 1838 and reported twenty years later.¹¹ Their patients

were two adults with cirrhosis who died from hemorrhage due to rupture of an esophageal varix. The few case reports which appeared in foreign journals up to 1880 ascribed the condition to alcoholic cirrhosis. In 1880 Le Due¹² encountered a case of syphilitic origin. The first case placed on record in the American literature is that of Van Bibber in 1887 in which the diagnosis was reached at necropsy. In 1897¹³ an editorial in the *Medical Record* stressed the importance of varicosity of the esophagus as a source of hematemesis and melena—occurrences almost exclusively identified at that period with gastric and duodenal ulcers.

PATHOGENESIS

The association of portal cirrhosis with esophageal varix was emphasized even by the older observers and today cirrhosis is recognized as the predominant cause of this esophageal anomaly which in turn is regarded as one of the commoner causes of hematemesis. Preble¹⁴ in 1900 reported sixty cases of fatal gastrointestinal hemorrhage and in 80 per cent of these, varices of the esophagus were found. Of 126 patients with portal cirrhosis collected by Blumenthal in 1920 19 per cent succumbed to vascular lesions principally varices of the esophagus. More recently (1929) McIndol¹⁵ reported twenty-six deaths due to portal cirrhosis and in 50 per cent of these the immediate cause was a ruptured esophageal varix. That esophageal varices may occur without concomitant cirrhosis is made evident by the researches of Nochimowski¹¹ who succeeded in collecting eight cases from the literature to which he adds two cases from personal observation. Each one of these ten patients succumbed to hemorrhage from rupture of a varix. The series comprises six male and one female adults and three children respectively three days, six years and eleven years old. Congenital weakness of the walls of the veins is probably a predisposing factor in the evolution of the varices in these cases. In the opinion of some the removal of the spleen may years later eventuate in the development of esophageal varix. This belief is especially prevalent among Italian observers. Alathie¹⁶ presents details of one such case.

INCIDENCE

The condition is more frequent than the scarcity of case reports would lead one to believe. It is Preble's opinion that routine injection of esophageal veins in the course of autopsies would reveal many unsuspected cases. Rossie¹⁷ states that from 7 to 8 per cent of deaths from cirrhosis are directly due to bleeding from an esophageal varix. French and German surgeons and pathologists are more keenly alive to the possibility of its occurrence than our American colleagues. Its highest incidence is reached at the age of from 35 to 40 years. However it occurs

in infancy and in childhood, as well as in the aged. In adult life, the male is more often affected than the female.

ANATOMICAL FINDINGS

The esophagus presents a fine network of veins, especially in its lower aspect. This drains chiefly into the coronary gastric vein which in turn empties into the portal vein directly or into the splenic vein near its junction with the portal vein. With the occurrence of portal obstruction¹³ the comparative directness of the communication of the portal and caval systems through the esophageal veins no doubt favors this over others as an anastomotic pathway. Lack of support of the submucosal tissue and the aspirating effect of the negative intrathoracic pressure with respiration and the incompetence of the valves in adult life are responsible factors.

SYMPTOMATOLOGY

Dilatation of esophageal veins may remain symptomless over a period of years. The most striking symptom is a sharp sudden vomiting of blood. The first hemorrhage, if massive, may prove fatal. More frequently hemorrhage recurs at intervals of weeks or months. Hematemesis may be preceded by coughing and a tickling sensation in the throat for about two weeks, which cease with the onset of bleeding. Hemorrhage may occur while at rest, or even during sleep, or following exercise. It may be precipitated by sharp particles of food or by use of the stomach tube. If loss of blood is extensive, a state of shock may supervene. If bleeding is repeated at short intervals, anemia or icterus may result, with loss in weight and strength. During active bleeding, fever is frequently noted. Gastric symptoms, including pain, are conspicuously absent. Blood in the stools, unaltered, or fairly in character, is almost invariably found. General dilatation of the venous system, especially involving the veins of the legs, scrotum and rectum, may coexist. Noehmowski¹¹ encountered two cases of this description. The endoscopic findings are graphically described by Gordin.¹² "Varices are most abundant at the lower third of the esophagus and at the cardiac orifice. They appear as irregular, tortuous and rounded nodular elevations on the surface of the folds of the esophagus, dark blue in color, easily compressible, strikingly like a clump of small hemorrhoids. The less advanced varices are seen as dilated bluish vessels having a sinuous course, close under the mucosa, through which they stand out vividly. Erosions may occur on the surface of the varices. A great amount of bleeding may occur from erosions of small size. In some the dilated veins reach the size of a lead pencil. However, the bleeding site cannot always be found. Noehmowski believes that when the condition is associated with cirrhosis, the esophagus is involved throughout its extent, and in the absence of ac-

accompanying cirrhosis, only the lower third is implicated. Operation discloses the stomach and bowels filled with altered or with fresh blood. These organs disclose no pathologic changes.

POSTMORTUM FINDINGS

Autopsy may reveal in addition to dilated esophageal veins hepatic cirrhosis and splenomegaly and less frequently cardiac and renal pathology. Dilatation of the veins of the legs, scrotum and rectum may coexist. In the presence of marked splenomegaly portal congestion and congestion of its tributaries are found. The affected veins may be found completely collapsed at autopsy even if these showed marked dilatation during life; thus the condition may readily escape detection. The point of rupture may likewise be quite inconspicuous. However injection with air or fluid will render it strikingly prominent. This procedure should be carried out in doubtful cases.

DIAGNOSIS

A diagnosis of bleeding esophageal varix is all too often made only at autopsy. The usual diagnosis is gastric or duodenal ulcer. A painstaking history and a complete blood study added to a comprehensive physical survey will help exclude such causes of hematemesis or melena as carcinoma, leucemia, agranulocytosis, venous anastomosis, rupture of aortic aneurysm into stomach, nasal or nasopharyngeal bleedings and in infancy or childhood particularly the hemorrhagic condition of the newborn, sepsis, thrombopenic purpura, hemophilia and a possible ulcer of Meckel's diverticulum. Gastric hemorrhage in association with enlargement of liver and spleen should be regarded as presumptive of a ruptured esophageal varix. Jolasse¹¹ reminds us that in young children and in males past forty gastric hemorrhage has its most frequent inception in esophageal varices whereas in the third and fourth decades peptic ulcer is the chief cause. Diagnosis may be assisted by the x-ray¹² following a barium meal. This will disclose marginal defects of the esophagus, permanent in situation and rounded or polypoid in outline. Chevalier Jackson and his associates and Wolf (1928) find the roentgenogram distinctly helpful whereas Cecil¹⁰ and others have failed to derive diagnostic aid from this source. The esophagoscope constitutes indisputably the most certain means of reaching a diagnosis.¹³ Cecil admonishes against endoscopic or even roentgenologic investigation during active bleeding. Others¹² however show no fear or hesitancy of utilizing these diagnostic agents even in the presence of active bleeding.

PROGNOSIS

Because of the frequent association of advanced cirrhosis, the prognosis in older patients is usually not promising. It is somewhat more favorable in the young because this causative factor is less frequently

operative Stephan¹² was successful in saving his three and one-half-day-old patient by means of energetic therapy, and Peiper¹⁵ met with equally gratifying results in connection with his two patients

MANAGEMENT

Conditions that are known to lead to the development of liver cirrhosis should be corrected. Active bleeding is an indication for complete mental and physical rest and a liquid diet. Bismuth subnitrate taken slowly with a minimum amount of water may be of help. Stephan obtained satisfactory results by the subcutaneous or intramuscular injection of gelatin supplemented by its use by mouth. Bland tepid food thoroughly masticated taken in small boluses, in the experience of Kirklin, Moersch, and others¹⁴ tends to prevent traumatization of the thin-walled varices. Avoidance of undue physical exertion should be stressed. In far-advanced cases the Talma Morrison operation whereby adhesions are established between various abdominal organs and the abdominal wall, resulting in the development of new anastomotic vessels, is advocated. Walters¹⁶ divides the coronary veins and their branches in order to interrupt the flow of blood into the esophageal veins. Splenectomy is advocated by some as a means of relieving an engorged portal circulation. In the experience of Mower and others this operation failed to check bleeding due to varix of the esophagus.

SUMMARY

This case report represents the unusual picture of idiopathic varix of the esophagus in a male child three and one-half years old. Only ten cases have thus far been reported in which the condition was not dependent upon hepatic cirrhosis. Two of these occurred in the newborn, and one in childhood. The symptomatology and course pursued in the case herein presented conformed closely with the observations of the reported cases. The striking features were recurrent gastric and intestinal hemorrhage extending over a period of one and one-half years, moderate weakness and anemia, absence of pain and gastric symptoms, febrile reaction during the stage of active bleeding, and death as a result of massive hemorrhage. A noteworthy departure was the frequency of stools over a period of several months. The true nature of the bleeding was suspected upon admission. Autopsy revealed prominent dilatation of the veins of the esophagus and ruptured esophageal varix. Neither the stomach nor the intestines showed any abnormality. Enlargement of the spleen and cirrhosis of the liver were not found.

COMMENT

Varix of the esophagus is of more common occurrence than is suspected from the scarcity of case reports. It should be thought of in all instances of bleeding from the gastrointestinal tract, particularly if splenic

or hepatic enlargement coexists. It may occur at any age. During childhood it is usually due to congenital weakness of the veins of the esophagus. In later life it is usually dependent upon hepatic or splenic pathology. The ultimate prognosis is poor, death usually occurring from loss of blood due to rupture of a varix. All types of treatment proposed have proved unsatisfactory.

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376 REPUBLIC BUILDING

HYPOTHYROIDISM AND CRETINISM IN CHILDHOOD

II CAPILLARY PERMEABILITY

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IT SEEMED desirable to examine the permeability of capillaries in a varied group of children for the purpose of comparison with our hypothyroid group.¹ To carry out this study we adopted the use of a cantharides blister which Petersen² and Gansslen³ have devised as a simple means of studying capillary permeability by determining the ratio of protein that comes into the blister when compared with the protein concentration of the blood serum.

METHOD³

Blisters were produced by a cantharides plaster placed in the middle of the inner surface of the forearm in the older children and between the scapulae in infants. They were applied at definite times (6-8 A.M. for ambulatory patients, 9-10 A.M. for hospital patients). In infants the area of application was observed at intervals for evidence of blister formation. The time when the first definite elevation appears has been taken as the blister time. In older children, an itching sensation commonly brings the plaster to the attention of the patient and in these instances the blister usually showed evidence of formation. The blister was evacuated soon after its appearance.

The refraction index of solutions is proportional to their protein content. The content of the latter in the blister fluid and in the blood serum is ascertained by determining their refraction indices. The readings for the serum are made according to the regular serum table, those for the blister fluid from the Reiss exudate table.

The factors underlying alterations in capillary permeability have been adequately discussed in a group of articles.^{3, 4}

The blister time is the period between the placement of the blister and the first evidence of its presence.

1. The permeability ratio is the

$$\frac{\text{percentage of blister protein}}{\text{percentage of serum protein}}$$

This coefficient indicates the actual degree of response of the capillary endothelium to a direct stimulus.

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We wish to express our appreciation to Dr. W. H. Petersen for his aid in this

2 The inflammatory index is the

$$\frac{\text{permeability ratio}}{\text{blister time}}$$

This coefficient reveals the effect of the autonomic tones

NONHYPOTHYROID GROUP ANALYSIS OF RESULTS

Blisters were applied to forty five hospitalized children (four of the group being colored) during the months of May and June 1932. The diagnosis in each is listed in the table. The children ranged in age from two months to thirteen years eight were one year and under twenty five were under eight years, and twelve over eight the oldest being thirteen. There were twenty female children and twenty five males.

The average time for blister formation was 14 hours the lowest time for production was 3 hours and the longest period 5 hours. In thirty five of the patients it took 5 hours or less for the appearance of the blister. In ten children it took over 5 hours being apportioned as follows in two 6 hours in one 6 1/2 hours in five 7 hours and in two 8 hours.

The average permeability was 66.6 the highest being 83 and the lowest 43. In twenty three children the permeability was above 66.6 and in twenty-one below.

The average inflammatory index was 13.8 per cent, the highest being 26.7 and the lowest 5.37. In thirty seven of the forty five patients this index fell between 10 and 17 per cent.

In this group of nonhypothyroid children blister determinations indicate that decreased permeability may be associated with increased blister time and increased capillary permeability may run along with decreased blister time. No reciprocal relationship exists between the degree of permeability and the length of blister time.

HYPOTHYROID GROUP

The hypothyroid patients studied were those discussed in the first paper of this series.¹ Petersen² studied the effect of hormones in a small series of goiter cases and demonstrated that increased thyroid secretion increased capillary permeability. Gellhorn and Northrup³ in perfusion experiments on animals found that thyroxin increased the permeability of the gut membrane. Gausslen⁴ in his studies found a short blister time in hyperthyroidism and a prolonged blister time in hypothyroidism and myxedema.

ANALYSIS OF RESULTS

Blisters were applied at intervals to eleven children with thyroid deficiency over a period of several months. These patients ranged in age from four months to fifteen and one half years. There were eight males and three females. The average time for blister formation in the

hypothyroid children when receiving thyroid medication was usually within the average time as determined in the group of nonhypothyroid children, namely, 54 hours

The permeability and inflammatory indices in the cretins taking thyroid extract were variable. The relation between these indices and the time necessary for the formation of a blister is similar to that found in the nonhypothyroid patients listed in Table I

TABLE I

GROUP OF 47 NONHYPOTHYROID CHILDREN ARRANGED ACCORDING TO AGE

	AGE	DIAGNOSIS	BLISTFR TIME HOURS	BLOOD PROTEIN	BLISTFR PROTEIN	PERME- ABILITY	INFLAM- MATORY INDEX
1	2 Mo	Normal	30	6.06	4.87	80	26.7
2	2½ Mo	Normal	55	5.19	3.17	61	11.0
3	2½ Mo	Normal	50	5.83	3.01	52	10.4
4	3 Mo	Pylorospasm	50	5.37	3.51	65	13.0
5	5 Mo	Normal	35	6.64	3.78	57	16.1
6	9 Mo	Upper respiratory infection	35	7.00	4.49	64	18.3
7	11 Mo	Cleft palate	50	5.89	4.21	72	14.4
8	1 Yr	Normal	45	7.11	4.49	63	14.0
9	1½ Mo	Pneumonia	50	8.15	5.10	63	12.6
10	1½ Mo	Achondroplastic dwarf	70	6.52	4.05	62	8.8
11	14 Mo	Cleft palate	45	6.12	4.49	73	16.0
12	15 Mo	Syphilis, malnutrition	40	6.76	3.01	44	11.0
13	17 Mo	Cleft palate	55	7.00	5.80	83	15.0
14	21 Mo	Cleft palate	40	7.52	4.16	55	13.7
15	2 Yr	Tuberculosis	70	4.73	2.46	52	7.4
16	2½ Yr	Feeble mindedness	45	7.87	4.70	60	17.0
17	2½ Yr	Cleft palate	35	7.57	4.54	60	13.3
18	3 Yr	Idiot	50	7.37	3.83	71	14.2
19	3½ Yr	Mongol	60	5.89	3.56	60	10.0
20	4 Yr	Feeble mindedness	40	6.94	4.82	69	17.2
21	4 Yr	Idiot	50	7.40	5.04	68	14.6
22	4 Yr	Eye case	50	6.34	4.97	77	15.4
23	4 Yr	Old palate	80	7.46	3.17	43	5.37
24	5 Yr	Eye case	40	7.69	4.21	55	13.7
25	5 Yr	Eye case	50	6.34	4.87	77	15.4
26	5 Yr	Cleft palate	50	7.52	5.47	73	14.6
27	5 Yr	Tonsillitis	40	8.85	5.85	66	16.5
28	5½ Yr	Rheumatic endocarditis	50	7.57	5.42	72	14.4
29	5½ Yr	Chorea	70	7.40	5.10	69	9.8
30	6 Yr	Herniotomy	80	7.00	5.63	80	10.0
31	6½ Yr	Tonsillectomy	65	6.23	4.62	74	11.4
32	7 Yr	Bronchiectasis	60	7.00	4.70	67	11.0
33	7 Yr	Sister of cretin, normal	60	6.40	4.11	64	10.7
34	8 Yr	Abscess chest wall, tuber- culosis	70	7.17	5.85	82	11.7
35	9 Yr	Chorea	40	7.75	4.49	58	14.0
36	9 Yr	Observation for headaches	45	Broke			
37	9 Yr	Cleft palate	45	7.34	5.04	68	15.0
38	10 Yr	Empyema	50	7.46	5.58	74	14.8
39	10 Yr	Eye case		6.87	4.59	66	9.4
40	11 Yr	Eye case	40	7.05	4.97	69	17.5
41	11 Yr	Endocarditis	50	6.12	4.43	72	14.4
42	11 Yr	Mental deficiency	50	5.49	4.43	81	16.2
43	11 Yr	Obesity	45	7.57	5.90	78	17.3
44	12 Yr	Brother of cretin, normal	35	6.00	3.72	62	17.7
45	13 Yr	Mongolian	45	6.32	5.15	75	16.6

TABLE II
HYPOTHYROID GROUP

	DATE 1932	AGE	PIGMENT	BLISTER TIME HOURS	HEMOCY- PROTEIN	WINTER PROTEIN	PERMP- ABILITY	INITIAL METABOLIC INDEX	REMARKS
1	June 21	1- yr	Cretin	0	0.2	2.87	40	11.6	Doing very well no trouble on - gr thy roid extract per day (ambulatory)
2	Feb 21	1; 5 yr	Cretin	?	0.71	4.0	110	?	1 gr thyroid extract per day (ambulatory)
3	July 25	14 yr	Cretin	None in 7 hr					3 gr thyroid extract per day (ambulatory)
4	Apr 28 June 27	2- yr	Cretin	3 1/2 0	7.00 0.2	63 71	800 700	23.0 1.0	1/2 gr thyroid extract per day (ambulatory)
5	Nov 21 Nov 28	4 Mo	Cretin	120 120	0.7- 0.3	47 0	40 63.0	4.8 ,	Note unusually high protein no thyroid (ambulatory)
6	Apr 19 June 2 July 7	4 1/2 Mo 6 1/2 Mo 7 Mo	Cretin	0 0 3	7.63 0.2 0.1	474 400 01	11 70 70	23.0 1 21.7	1/2 gr thyroid extract per day 1/2 gr thyroid extract per day No thyroid extract for 2 weeks (hospital)
7	Mar 13 June 11 Dec 30	0 yr 0 yr 0 yr		No Blister 37	01	701	70	4.47	Off ther 11 extract 1 month Off thyroid extract 1 - months (ambulatory) On 2 1/2 gr thyroid extract per day for 20 months
8	Feb 17 Mar 2 Mar 10 Mar 31 Apr 11 Apr 19 July 8	2 yr 4 yr	Cretin	0 0 0 70 40 10 70	0 0.09 8.13 8.1 8.03 7.97 0.1 9.04	10 333 040 018 21 63 40 1	190 070 70 70 040 40 660 040	1.6 9 1.4 12.66 1.4 18 16 12.9	No thyroid extract since 1/17/32 Insulin 6-8 units since 2/27 Insulin 6-8 units since 2/2 1 mgm thyroxin 2/2/32 1 1/2 mgm thyroxin intravenously Thyroid extract 2-1/2 gr per day

Withdrawing thyroid extract in these patients who have been receiving this medication results either in an increase in the time or an inability to form a blister. This is illustrated in patients 7, 9, and 10.

G M (No 7) had been off thyroid for one month prior to his blister of May 13, and for two months previous to the blister of June 11, 1932. Blisters did not appear. Associated with the failure to raise a blister were a fall in the basal metabolic and pulse rates, and a gain in weight.

J F (No 9) on February 16, 1932, while receiving 2 grains of thyroid extract per day, raised a blister in three hours. The permeability and inflammatory indices were both unusually low. On April 30, he was not able to raise a blister, having been off thyroid medication for two weeks previous to this date and having been on reduced dosage of thyroid extract during the time he had chicken pox. On May 27 after resumption of thyroid medication, a blister appeared in six hours, the permeability ratio was 74, and the inflammatory index, 12.33. On June 23 he entered the hospital for further study. He had been on from 2 to 3 grains thyroid extract per day. Thyroid medication was stopped, the time for formation of blister rose, and the permeability changed to decreased levels, but the inflammatory index definitely fell. After resumption of thyroid medication the blister time fell, permeability again changed but little, and the inflammatory index rose.

O K (No 10) was admitted to the hospital on June 20, 1932, having been on from 2 to 3 grains thyroid a day at home. This preparation was given very irregularly by the parents. After being off thyroid for a short period, the time for blister formation rose, but with the resumption of thyroid medication the results were too varied to allow the drawing of conclusions.

Patients Nos 5 and 11 are female cretins who never received thyroid. D B (No 5), four months old, was unable to raise a blister under twelve hours. The permeability readings were 58 and 63, and the inflammatory indices were 4.8 and 5.25.

R P (No 11), aged four and one half years, had six plasters applied from September 9 to 21, and no blisters appeared at any time. Because her tongue was large, and since she vomited so readily, thyroxine was administered intravenously. On September 19, 1932, $\frac{1}{2}$ mgm thyroxine was given, and on September 23 she raised a small blister, the time not being known, the permeability was 77 per cent. On September 26 after having received a second dose of thyroxine intravenously she raised another small blister, the time not being obtained, the permeability was 89 per cent. From then on she was able to raise a blister usually within five hours. After a time blisters formed so rapidly that before blister fluid could be obtained they had broken. It is interesting to note that on November 7, because of a severe upper respiratory infection, thyroid medication was stopped and not resumed again until November 23. During this period she raised blisters within the five hour period.

SUMMARY

1 Capillary permeability by means of the cantharides plaster was studied in a group of forty-five nonhypothyroid and eleven thyroid deficient children.

2 In the nonhypothyroid group a single application of the plaster was made. The average time for blister formation was determined as 5.4 hours, twenty-nine falling within the range of 4 to 5 hours.

3 In the eleven hypothyroid children several applications were made in each patient and in one instance as many as twenty six

4 Three of the nine children receiving thyroid were removed from this medication

(a) One of these was unable to raise a blister

(b) In two the time for blister formation rose considerably

5 Of two female cretins who never received medication one was unable to raise a blister under 12 hours and the other not until thyroid therapy was instituted

6 The absence of reciprocal relationship between the time of formation of blisters and the degree of permeability is indicated in the non hypothyroid group

7 The variability of the permeability and the inflammatory indices in the thyroid deficient children and the relation between these and the blister time is similar to that found in the nonhypothyroid group

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THE EFFECT OF COOKING ON THE DIGESTIBILITY OF CEREALS

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IN THESE experiments we have determined the effect of cooking on the digestibility of the starches of various cereals. In the past the consensus of opinion has favoured a comparatively long period of cooking. Recently, however, there is a tendency to question the necessity of such long cooking periods in preparing cereals for the diet of the average child.

A number of feeding experiments have been done with human subjects to determine the coefficient of digestibility or the percentage of the total carbohydrate of the various cereals which is digested and absorbed.^{1 2 3 4 5 6} These experiments show that during the period of digestion in the human subject practically all (90 per cent to 98 per cent) of the carbohydrate of cereals is utilized, but they do not indicate the ease of digestibility, that is, whether complete digestion occurs more rapidly with one cereal than with another, or what influence the time of cooking may have on the digestibility.

Experiments on the digestibility of cereals have recently been reported by Noble, Dean Wing and Halliday.⁷ These *in vitro* experiments indicate that digestion is as complete after twenty minutes of cooking as after ninety minutes of cooking.

The process of starch digestion in the animal body may be described as the hydrolytic breakdown of the complex starch molecule to the simple sugar, glucose. The intermediate products in the hydrolysis are soluble starch, dextrins, and maltose. The principal enzyme involved is pancreatic amylase, with ptyalin and finally maltase also taking part in the hydrolysis. From 30 to 76 per cent of the food cellulose is also digested, but this is accomplished by the intestinal bacteria, as none of the enzymes in the higher animals are capable of splitting cellulose.⁸

METHOD

In the following experiments the amount of maltose formed in a given time under standard conditions was taken as the measure of starch digestibility. The amount of maltose formed by digestion was obtained by subtracting from the total amount formed in a sample which had been cooked and then digested, the

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amount found in an aliquot sample which had been cooked for the same length of time and treated in exactly the same manner except that the digestive enzyme was destroyed immediately before any digestion had taken place.

To judge the effect of cooking on starch digestibility in a given time the following periods of cooking were selected: 0, 5, 15 and 30 minutes, 1, 2, and 4 hours.

One gram samples of the dry cereal were weighed into each of seven pairs of 100 cc Erlenmeyer flask. 10 cc of water was added to each and the flasks placed in boiling water for the desired length of time. The flasks were loosely stoppered and were agitated during the early stages of cooking in order to eliminate lumping and skin formation both of which according to other investigators¹⁰ result in retarded digestion. Observations of the temperature within the cooking flasks showed a rapid rise to 100° C during the first five minutes of cooking. The maximum temperature observed was 98° C.

After removal from the water bath 10 cc of water was added making a total of 20 cc. Uncooked samples were allowed to stand in water at room temperature for one hour to ensure saturation of the cereal with water before digestion.

To all the flasks were then added 10 cc of 0.1 M dihydrogen phosphate buffer, 1 cc of 0.2 N NaCl and 1 cc of enzyme solution which was a 1 per cent solution of leucic acid powder as in 1 per cent sodium bicarbonate. This solution should be prepared fresh each day. It contains adequate amounts of the starch splitting enzyme amylase.

The enzyme action in one of each pair of flasks was stopped immediately with 5 cc of 3 N H_2SO_4 . The others were incubated and digestion allowed to proceed for exactly thirty minutes in a water bath at 37° C. The enzymic action was then stopped in this group by the addition of the same amount of acid. At this point the total volume of liquid was 40 cc. All calculations were based on this volume. After centrifugalization lasting ten minutes and clarification of the supernatant liquid with Lloyd's reagent maltose determinations were made on 5 cc samples of the clear filtrate by the Willstätter method.¹¹ This consists in adding 0.1 N NaOH until the reaction is faintly blue to thymolphthalein then exactly 3 cc in excess. Two cc of 0.1 N iodine solution are then added and the flasks placed in a water bath at 20° C for fifteen minutes. The mixture is then acidified with 3 N H_2SO_4 (1 cc for each 10 cc of NaOH used) and the excess iodine is titrated with 0.01 N $Na_2S_2O_3$.

RESULTS AND DISCUSSION

Using the above procedure the following cereals were studied: Cream of Wheat, Menda's Cereal, whole wheat meal, corn meal, rolled oats and quick oats. Four complete series of estimations were made on the first two cereals and two series on each of the remaining four. The results are summarized in Table I and Charts 1 and 2.

From the table and still more clearly from the charts, it can be seen that cooking five minutes in a double boiler brought about a very rapid increase in the ease of digestibility as shown by the amount of sugar formed under the stated conditions, that cooking for a total of fifteen minutes and still further for thirty minutes, caused an appreciable but less marked increase, but that cooking longer than thirty minutes effected no significant increase in the amount of maltose

TABLE I

AVERAGE AMOUNT MALTOSE FORMED FROM ONE GRAM CEREAL AFTER VARIOUS PERIODS OF COOKING AND A UNIFORM DIGESTION PERIOD (THIRTY MINUTES)

TIME OF COOKING	CREAM OF WHEAT (MG)	WHOLE WHEAT (MG)	CORN MEAL (MG)	MEAD'S CEREAL (MG)	QUAKER ROLLED OATS (MG)	QUICK QUAKER OATS (MG)
Raw	4	5	13	11	25	29
5 min	74	72	111	88	108	104
15 min	106	105	126	115	117	133
30 min	125	116	138	131	133	127
1 hr	136	125	139	135	141	143
2 hr	153	134	147	143	142	150
4 hr	158	136	152	142	149	149

formed, except in the case of Cream of Wheat, in which there appears to be a slight increase up to the two-hour period

In addition a precooked form of Mead's Cereal was also tested * This product is prepared by cooking Mead's Cereal mixture in large

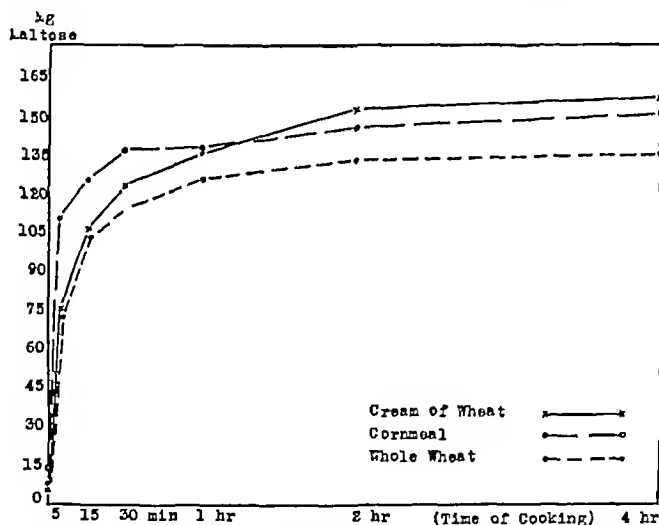


Chart 1—Average amount of maltose formed from 1 gm cereal (thirty-minute digestion period)

kettles under steam pressure for twenty minutes then drying on a drum dryer. Samples of this were weighed out and allowed to stand in 15 cc of cold water for one hour at room temperature. Without being subjected to any further cooking they were digested as in the case of the other cereals. Six estimations of the digestibility were made and the results are shown in Table II.

From Table II it is shown that when 1 gm of the precooked cereal is digested thirty minutes 183.22 mg maltose is produced. This is a considerably greater maltose production than is found when the same digestive procedure is carried out with any of the other cereals. It

*Pabulum

TABLE II

THE DIGESTIBILITY OF ONE GRAM OF PRECOOKED CEREAL MIXTURE AS SHOWN BY SUBTRACTION OF MALTOSE PRESENT IN UNDIGESTED CEREAL FROM MALTOSE FOUND AFTER THIRTY MINUTE DIGESTION

ZERO DIGESTION MALTOSE PRESENT (MG)	THIRTY MINUTE DIGESTION TOTAL MALTOSE FOUND (MG)	DIFFERENCE MALTOSE FORMED (MG)
57.12	171.08	114.00
54.81	177.08	122.08
40.80	217.60	176.80
44.0	181.0	137.0
41.8	183.0	141.0
41.8	187.0	145.0
AVERAGE 47.66	180.78	133.12

is possible that this increased digestibility of the precooked cereal is due to the method of pressure steam cooking to which it is subjected during manufacture

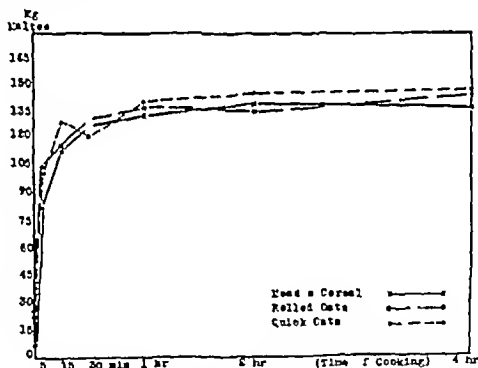


Chart — Average amount of maltose formed from 1 gm cereal (thirty minute digestion period)

DETERMINATION OF TOTAL SOLUBLE CARBOHYDRATE FORMED BY DIGESTION

A report by Snyder in 1902 stated that the digestibility of rolled oats was considerably greater following a four hour cooking period than following a thirty minute cooking period. He based this conclusion on his findings which indicated that there was over three times as much soluble carbohydrate formed by malt digestion after cooking four hours as there was after cooking for thirty minutes. It was thought advisable to repeat this type of experiment and determine the total soluble carbohydrate formed after varying cooking periods and a uniform digestion period.

Determinations of total soluble carbohydrate were made on two of the cereals, namely, rolled oats and Cream of Wheat. The method of preparing the cereals was the same as before, except that following digestion the digests were filtered through No. 40 Whatman filter papers, and the filtrate then hydrolyzed for three hours in a boiling water-bath with dilute hydrochloric acid which converts the soluble starch and dextrans to dextrose. The dextrose content of 2 cc portions of this solution was then determined and calculated as maltose.

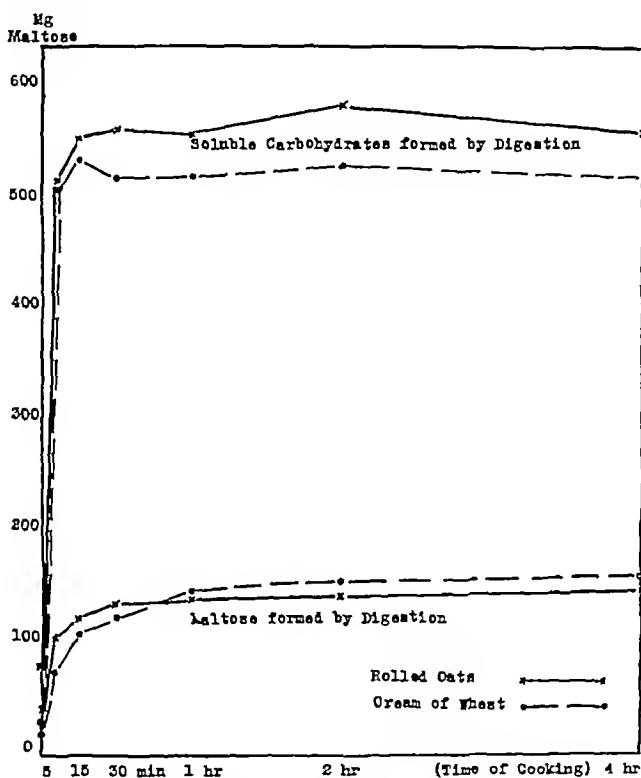


Chart 3—The effect of various cooking periods on the digestibility of the carbohydrates of Rolled Oats and Cream of Wheat.

The results of these estimations are shown in Table III and Chart 3. It will be seen that there is considerable similarity between the curves of maltose production for a thirty-minute digestion period and the curves for total soluble carbohydrate formed after a similar digestion period, except that the magnitude of the latter is considerably greater (4.1 times).

We have been unable to confirm Snyder's findings that the digestibility of rolled oats was over three times as great after four hours' cooking as it was after thirty minutes' cooking.

TABLE III

TOTAL SOLUBLE CARBOHYDRATE FORMED AFTER VARIOUS PERIODS OF COOKING
AND A UNIFORM DIGESTION PERIOD (70 MINUTES)

TIME OF COOKING	ROLLED OATS		CREAM OF WHEAT	
	TOTAL SOLUBLE CARBOHYDRATE (MG.)	AVERAGE (MG.)	TOTAL SOLUBLE CARBOHYDRATE (MG.)	AVERAGE (MG.)
Raw	81.6		44.0	
5 min.	76.2	7.0	41.8	7.0
	111.0		122.4	
15 min.	102.1	10.8	101.6	112.0
	137.0		197.7	
30 min.	136.0	16.8	170.4	133.8
	162.0		110.0	
	162.1	16.0	49.5	117.9
1 hr.	140.8			
	157.8		100.0	
	146.0	30.2	101.2	118.6
2 hr.	157.0		106.0	
	181.0	18.0	188.4	127.2
4 hr.	176.0		112.0	
	168.4	16.4	100.0	116.0
	157.3			

CONCLUSIONS

1 Cooking for more than thirty minutes in a double boiler did not significantly increase the digestibility of cereal starches as shown by the amount of maltose and of total soluble carbohydrate formed *in vitro* under standard digestion conditions.

2 No significant differences were found in the relative starch digestibility of Cream of Wheat, corn meal, Menda's Cereal, Quaker rolled oats and Quick Quaker oats. Whole wheat however was slightly less readily digested.

3 The starch digestibility of a special precooked cereal mixture was more rapid than the starch digestibility of any of the other cereals tested.

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THE DISCARD OF THE CRADLE

JOHN ZAHORSKY, M D

St LOUIS, Mo

THIS article will begin by paraphrasing a sentence from the work of the distinguished scientist, Prof A S Eddington. The practice of pediatrics "would be stunted and narrow if we could feel no significance in the world" of childhood "beyond that which can be weighed and measured with the tests of the physicist or described by the metrical symbols of the mathematician."

In accordance with this thought I venture to drag a discarded piece of furniture from the attic and talk about it in the light of my experience as a pediatrician. This is not merely a sudden fancy of old age, it is a conviction of thirty-five years of observation.

However, before taking up the subject of the cradle, an introductory study on "amusing the baby" seems necessary.

AMUSING THE BABY

Probably some of our older pediatricians were not psychologists and may not have been versed in the folklore of amusements. Possibly they were influenced by such sayings as that of Pascal, "Amusement allures and deceives us, and leads us down imperceptibly in thoughtlessness to the grave." It seems they were not impressed by the admonition of Addison to "encourage innocent amusement." Or, were they so engrossed in the physiology and pathology of the body that the effect of psychic reactions to external stimuli was entirely ignored? It seems so. At any rate we find the following axiom laid down by a prominent pediatrician (Cotton) in 1900, "An infant during the first year should neither be amusing nor amused."

Such was the hard-hearted and inexorable maxim of a conscientious practitioner. Even at that time the grave consequences of institutional life were easily accessible, and the founding or hospitalized infant served as an outstanding example of the neglected infant who had not been amused. Yet he inscribed this amazing precept in his book.

L Emmett Holt as late as 1916 laid down this guiding rule, "Playing with young children, stimulation to laughter and exciting them by sights, sounds or movements until they shriek with apparent delight may be a source of amusement to fond parents and admiring spectators but is almost invariably an injury to the child."

Read before the St. Louis Pediatrics Society December 4 1933

One looks in vain for clinical observations that support this emphatic proposition. When and where has the young child been harmed by shrieking with laughter? In fact the most cursory observations among happy families would throw serious doubt on this unqualified statement.

Recent textbooks give more space to the value of play in developing the child and yet the warning against amusements is not wholly eradicated. Thus Griffith and Mitchell* in the textbook of 1933 state: "Amusements begin early and these may be gradually added which educate the mind to a certain extent. Yet the training of the mind must always hold a secondary place lest overstimulation of it result. In fact all amusements which cause much excitement are to be avoided and this is especially true just before bedtime or insomnia will naturally result."

Thus considerable stress is still laid down on the harmful effect of a "good time" just before bedtime. The young father at home from his daily vocation wants to play with the baby but play at that time is interdicted by the modern trained mother. Hence so many fathers never have a chance to become acquainted with their children.

The young child likes to play after supper and as a rule by bringing on a sense of fatigue the sport promotes rather than inhibits healthy sleep. Of course this can be overdone but my observation leads me to believe that this rarely happens except on festival occasions as the night before Christmas.

Now compare the quotations from pediatricians with the statements of Katherine Oettinger (Hygeia December 1933). Play is just as important a part of baby's life as sleeping or eating. Baby must feel happiness after he has done the thing you are teaching him.

We pediatricians have really done harm by the excessive emphasis laid on the possibility of spoiling the child. How often have we seen an infant four or five months old laid in the crib with his bottle and no attention paid to him or placed in another room at bedtime and the door closed! This is not care it is absolute neglect of the infant. Fortunately, the parent's love in most cases has not acquiesced in these iron bound rules. The fond mother keeps an eye on her infant and the grandmother cannot endure its cry. We have been too hard on grandmothers! It is a perfectly natural impulse of maternal love to please the baby. What right have we to overrule this natural impulse?

I have felt a great deal of satisfaction from the recent publication by Dr. Knight Dunlop, Professor of Experimental Psychology at Johns Hopkins University (Science News Letter June 10 1933). He criticizes certain regulations recommended by some influential physicians and pronounces some of these so-called scientific methods as systematic neglect to quote him. The baby which is neglected does in the course of time adjust itself to its unfortunate environment. Such babies become good babies and progressively easier to neglect. Such procedure is no more

justified by these results than is the method of keeping the baby mildly drugged. The baby should not be allowed to cry, or rather crying should be minimized, and never allowed to continue long."

Another common dictum found in nurses' textbooks on nursing is that the baby should amuse himself, and for this purpose some toys are placed in the crib. Is this not another form of willful or unavoidable neglect? Dr. Dunlap gives a clear statement on this practice. "The baby should be allowed to amuse itself only for short and carefully controlled periods. It should be amused during practically all of its waking time."

I believe every pediatrician who has children of his own and has watched the growth of children in the homes of the middle class will concede this point. How can the baby amuse itself unless some one teaches and demonstrates the steps of the play? Even the adult finds any sort of sport or play dull and tiresome when alone. And should we expect more from the baby?

But the great objection is that you will spoil the baby by paying too much attention to it. Perhaps, this is sometimes true. Here is what Dr. Dunlap writes. "Of course, keeping the baby happily stimulated during its waking periods and preventing crying, while not 'spoiling' the child is a difficult task, too difficult, perhaps, for the intelligence of the parents. Spoiling the child, however, is a minor evil, neglecting it is a major one."

I am inclined to believe that this great fear of overstimulation should be placed in the same category as overfeeding which was expounded with such emphasis only a decade ago. Of course, there is danger of overfeeding but it is insignificant compared with the destructive effect of underfeeding. There may be some danger in overstimulation, but its ultimate consequences are trivial compared to the backwardness produced by continuous understimulation.

When should this playing with the baby begin? My answer is as soon as the baby responds in a happy way to external stimuli. The first play is to be carried around to different lights, different movements, and different scenes. Soon come toys, and the baby is shown how to use them. While the play is primarily prescribed to encourage exercise and teach useful movements of the body, a psychic stimulation invariably goes with this. It is desirable that the exercises produce joy and not distress. Instinctively the parents want the baby to smile and later laugh heartily. Every infant should be enticed to smile or laugh every day. We have often encountered neglected infants who rarely or never laugh or smile. I have seen these same infants develop into children who lack the exuberant hilarious spirit of the normal child.

I venture, therefore, to propose a new precept by contradicting the axiom of Dr. Cotton. "An infant during the first year of life *should* be amusing and be amused."

As a matter of practice I believe we can safely leave the question of amusement of children to the parents. The infant practically always responds to overstimulation by a cry of anger or distress and then the stimulation stops abruptly. Most parents soon learn when the baby gets tired of the game. Why should the pediatrician circumscribe this activity with gratuitous regulations based on prejudicial or at least on shadowy hypotheses?

THE CRADLE

What a folklore has accumulated about the cradle! Most of us remember only Wallace's famous distich

For the hand that rock the cradle
Is the hand that rules the world

Perhaps we have not forgotten that beautiful poem of Elizabeth Allen

Backward turn I toward O Time in your flight
Make me a child again just for tonight

Each stanza ends in that soothing refrain

Rock me to sleep moth'r rock me to sleep

We still laugh over the speech of Mark Twain given in honor of General Grant in response to the toast, The Babies. He mentions the 'three or four million cradles now rocking in the land.' This was in 1879. Ten years later the general destruction of the cradle began. This was accomplished at first only in foundling homes but also spread to the baby hospitals and obstetric departments of the hospitals. It seemed so unnecessary to rock the newborn. By 1890 the trained nurses from such institutions were beginning to attack the use of the cradle even in the home. They had become firmly imbued with the idea that the baby's principal complaints were due to overindulgence by fond parents. The cradle was the first step in spoiling the baby and hence this practice must be destroyed at its inception. For example Lizabeth D. Price in her textbook of nursing (1892) specially emphasizes in italics that the baby "should never be rocked nor hushed on the nurse's neck."

I had the opportunity to follow this attack on the cradle during my early professional career. It seemed to me then that the greatest influence emanated from the babies' hospitals in New York, Philadelphia and Chicago, since many of the writers in our prominent women's magazines had received their training there. In the nineties all these magazines published numerous articles on the care of the baby. Many of these contained vicious attacks on the use of the cradle.

The greatest influence however was exercised by the textbook of Dr. L. Emmett Holt. In the first edition (1897) we find this statement "To induce sleep rocking and all other habits of this sort are useless and may be harmful. I have known of one instance where the habit of rocking

during sleep was continued until the child was two years old, the moment rocking was stopped the infant would awake "

At another time he wrote (1916), "The crib should be one that does not rock in order that this unnecessary and vicious practice may not be carried on "

Holt's teachings were widely circulated through his mother's guide, "The Care and Feeding of Children" (1910). In this he answers the question, "Is rocking necessary?" "By no means. It is a habit easily acquired but hard to break and a very useless and sometimes injurious one "

If we study subsequent textbooks by various writers we find a similar warning. Lucas makes it very emphatic. "The hand that rocked the cradle has happily passed out of the modern nursery. No baby should be rocked, petted or otherwise entertained while he is going to sleep." Chapin and Royster are much milder in their directions, "Rocking as a preliminary or accompaniment of sleep is undesirable." The tenth edition of Holt has practically the same instruction on this practice as the first. The new textbook of Griffith and Mitchell has this statement "Walking the floor, rocking, singing to sleep, and the like are entirely unnecessary. They establish the child in a bad habit and make a slave of the mother."

Ramsay, in Abt's Pediatrics (1923), expresses the usual thought, "The old habit of rocking or walking the baby to sleep is a pernicious one and has nothing to recommend it."

Finally I quote from the standard nursing textbook on pediatrics by Bessie Cutler (1927), "The child must never be rocked to sleep, given a pacifier or any soothing device."

It seems to me that many of these statements are but echoes of the past. There was a time when nurses felt that the infant life could be regulated by scientific rules even in every home. Did we not prescribe a definite quantity of food made up of an accurate composition? Have we not tried to regulate the hours of sleep and exercise? Did we not repress the desires of the growing infant into a narrow groove? Did any trained nurse or pediatrician ever inquire of the mothers of two or three children whether or not she found the cradle helpful in the care of the baby?

Many years ago I wrote an article on the cradle protesting against the general expulsion of this convenient and inexpensive furniture from the nursery. The older child has his rocking horse, swing, kiddy-car, or scooter, the baby has a rigid non-bed, the crib, or the bassinet.

I desire once more to bring up the subject of rocking in infancy, and give some clinical impressions why this subject should not be dismissed as fully settled. I will concede at the outset that rocking is usually unnecessary. Necessity is, however, not the only reason for establishing certain practices. Every one can easily recall many diversions of our

childhood which were very pleasant but really not necessary. Probably most of the toys given to children are not necessary. Playing or amusing the baby are really not necessary. The baby learns to adjust himself to all kinds of parental neglect as Dr. Dinnlap so tersely stated.

We can dismiss the alleged injurious effect of rocking with a few sentences. The only bad effect observed by any one is that the practice may become a habit which is hard to break. But is not this also true of breast feeding, bottle feeding, and other practices in infancy?

Another objection is that this spoils the baby. It is contended that the healthy baby should fall asleep without any soothing measures. But does it? It is generally acknowledged that the deep sleep of childhood does not manifest itself until later. As a rule babies are poor sleepers. True the baby may become exhausted from crying itself to sleep, but few parents have the hardihood to endure this without making some effort to soothe the baby. I feel that Dinnlap is correct in teaching that crying in a baby should be minimized. Soothing some babies to sleep is good practice.

Here I wish to lay stress on the favorable effect of rocking on the life of the young infant. I must admit that the conclusions are based entirely on clinical impressions. But was it not the clinical impression of some nurses and physicians which abolished the use of the cradle?

Let us recall briefly the more obvious physiologic effects of rocking. It has a cooling effect since the motion acts as a gentle fan and hastens evaporation from the skin. *The gentle swaying motion has a soporific influence.* It is distinctly soothing to the excited nervous system.

There is however one effect which it seems to me has been entirely overlooked, namely the assistance to the pendular movements of the intestine. In addition in the chyle the intestine always contains gas, and the swinging movements of its body causes the liquid chyle to gravitate backward and forward over the intestinal mucosa. Rocking, therefore, is a physical therapy which aids digestion and probably absorption. It is precisely the young infant who suffers from intestinal dyspepsia especially when breast fed.

The many jokes on the young father and the dyspeptic baby have their source in actual experience. The spitting up, the violent attacks of colic, the insomnia, the distended abdomen, the passage of flatus, and the meconid thin stools are the principal diagnostic symptoms. It would lead too far in this paper to offer an explanation of these symptoms. As a matter of fact the actual mechanism is not really understood and gratuitous hypotheses are numerous. But I have certainly obtained the clinical impression that young infants who are rocked after nursing as a rule have less colic, less enterospasm and become happier babies than those who are laid in the crib without rocking. In fact I have several times availed myself of this physical therapy even in recent years to re-

lieve the dyspeptic young baby. But it is difficult to procure a cradle now. Again and again I could not prescribe rocking because a cradle could not be found.

Stress must be laid, then, not on rocking the baby to produce sleep, but rocking the baby to relieve certain annoying digestive symptoms. The baby is rocked not necessarily at its sleeping time but after a feeding. When the symptoms are relieved, the baby goes to sleep.

In my opinion the total discard of the cradle has at least aided in two unfortunate results, first, there has been a definite increase in bottle-fed babies, and second, an increase in umbilical hernias.

The insufficiency of the mammary function in our modern young mothers is too serious even to allow words of derision or merriment. By far the most common cause is, to use the language of the laity, the fact that the milk does not agree with the baby. The dyspeptic symptoms are so violent, the baby cries day and night and, consequently, the baby is put on the bottle. Many of these unfortunate results can be prevented by rocking the baby after nursing. I firmly believe that the cradle assists maternal nursing.

The second effect, the more frequent occurrence of umbilical hernias in the modern infants, has a partial explanation in the increased flatulency in the unrocked babies. Rocking, by increasing peristalsis and food absorption diminishes the formation of gas, and the increased pendular movement facilitates its expulsion.

In actual experience rocking has not been abolished. We find the majority of mothers wheeling the crib back and forth, jolting the mattress up and down, or swinging the baby in a rocking chair. The baby carriage has become a common bed for the baby and jolting the infant up and down on the springs is a very common practice. None of these, however, can take the place entirely of the easy side-to-side movements of the cradle. The common use of the pacifier and the frequency of thumb-sucking also reveal that well-known soothing measures are still employed.

The question of the cradle, that is the physiologic effect of rocking, is really a good subject for scientific research. If these remarks will stimulate some worker to undertake such a study, the purpose of these remarks will be accomplished.

Here some quotations from two old masters, who were backward in science but proficient in domestic practice, may be interesting.

"There has been at all times a considerable expenditure of words, and much learned trifling with regard to the question of the salubrity or insalubrity of cradles. It appears to us that their employment or non-employment is a matter that may very safely be left to the fancy or convenience of the parents. A cradle makes a clean, airy, and, from the facility of moving it about, a convenient bed. As to the injury likely to

be inflicted upon the central nervous system by rocking we have not the shadow of a proof that such species of motion is ever injurious to the brain " (Fevanston and Mannselt 1842)

A cradle for young children is a very important appendage to the nursery notwithstanding the objections which have been made against it by ingenious speculators upon the subject of the physical education of children The advantages of the cradle are first it can be placed in any situation in the room without disturbing the child for the advantage of either warmth or coolness for light or darkness or for air second it supplies the most gentle and certain anodyne it we may so term it since it will amuse by its motion when the child is placed in it awake, lull by its sameness when disposed to sleep The objections to the use of the cradle are easily obviated (Dewees 1847)

Apparently the same professional attitude which originated the celebrated maxim of Cotton also was responsible for the destruction of the cradle Some day, I believe it will be no disgrace to rear the young baby in a cradle and even sing him to sleep by a lullaby

5 6 NORTH TAYLOR AVENUE

CHICKENPOX IN AN EIGHT-DAY-OLD INFANT

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ON JANUARY 2, 1934, I was called to see a four day old infant in the Out Patient Obstetrical Service of the Presbyterian Hospital, Chicago. The child at that time showed no abnormalities whatever except a slight phimosis. He weighed 8 pounds, stools were normal and he was nursing well at the breast. There were no lesions of any sort on the skin.

Eight days later, the same infant then thirteen days old, presented a very different picture. The entire surface of the body presented an eruption characteristic of varicella at the height of its eruptive stage. The lesions were of the macular, papular, pustular, vesicular, and crusted variety. Vesicles and crusts were especially prominent on the trunk and scalp. The lesions seemed to lie on the skin and not deep in the tissue. The crusting, though definite, was apparently not of long duration. None of the scabs could at this time be brushed off. The larger vesicles were about $1\frac{1}{2}$ cm in diameter. Occasional umbilication was observed. The vesicles contained a thin, yellow, serous fluid and were in places confluent, chiefly on the anterior chest and scalp. Pustules, though present, were quite infrequent. The palms of the hands and soles of the feet were affected. Flat red spots intermingled the older lesions over the entire body. The external ears and nares were partially occluded by the presence of thin walled vesicles and semi solid, newly formed crusts. Several cutaneous ecchymotic and bleeding areas were noted on the face, particularly at the palpebral margins. The lips were dry and chafed without discrete lesions. The oral mucous membranes were also involved. The tongue was rather dry and papilla prominent. Maculopapular, roughly circular white patches of various sizes could be seen on the buccal mucosa. They were most plentiful in the palatine region. The posterior pharynx was injected and patchy. The general odor was slight. Rectal temperature was 98.6° F, heart rate was 174, lungs were clear. The infant was alert and not inactive, became irritable when disturbed and was assumedly very uncomfortable. Earlier in the day the patient had nursed at the breast eagerly and taken water freely. Only for the two previous days had he been reluctant to take his feedings. The general constitutional signs of an acutely ill infant were lacking.

The day before this examination (January 1, 1934), a private physician had been called to see the newborn infant. A diagnosis of impetigo contagiosa had been made and calamine lotion prescribed. The lotion had been sparingly applied. The infant seemed relieved.

The most likely diseases to be considered in this instance were variola, varicella, and impetigo contagiosa. The history was of importance in making a differential diagnosis.

There were a family of four, including mother, father, newborn infant, and a two year old son. The father was the only member of the family that had once had chickenpox and had been vaccinated for smallpox.

On the eve of December 28, 1933, the mother, a white American multipara, twenty two years old, delivered the infant. Delivery in the home was normal and not remarkable. A slight rise in temperature was recorded by the visiting nurse for the four days following delivery, the highest being 99.4° F on the second postpartum

day. Pulse and respirations did not fluctuate from normal. On the fifth postpartum day the temperature was 98° F., pulse 84 and respiration 30. The mother at the time of delivery recalled mentioning to the district physician in charge that she had noticed several red spots on her left thigh. She neglected, however, to mention the fact that on December 18, twenty days before her confinement, a neighbor child living under the same roof had been ill for a few days with fever and eruption. (This case was not diagnosed impetigo by the private physician.) Further the mother did not mention that on December 18, ten days after the neighbor's illness and nine days before her confinement, her two-year-old son had a similar episode with fever and eruption. The son was not confined to bed. His temperature was not taken. He was under the weather for only a few days and broke out as did the neighbor child. A doctor was not called. The lesions disappeared by forming crusts and dropping off. They left three or four shallow pitted scars in each case.

The red spots on the mother's thigh proved to be the first crop of a chickenpox eruption. On the fourth postpartum day the reaction was at its peak with macules, papules, and vesicles. They later dried, formed crusts and dropped off. Itching was her only complaint.

The infant suckled and thrived until the morning of the eighth postpartum day (January 6) at which time the mother first noticed red spots on his body. These progressed in the same manner as the other to present the picture previously described. The infant made a rapid and uncomplicated recovery.

We have here, a fairly clear-cut progression of events with four individuals involved. The history, the very mild symptoms, the appearance of successive crops of superficial vesicles, the formation of crusts and the rapid recovery in all four cases warrant the diagnosis of chickenpox.

Lesions on this newborn infant were first observed on the eighth day after birth. In all probability the infection was transmitted from the mother to the child in utero—congenital chickenpox.

The incubation period of varicella is somewhat variable. Gregory¹¹ says it does not exceed four days and is certainly less than seven. Modern writers do not agree with Gregory.

Their beliefs are as follows: Trossau¹¹ twelve to twenty-seven days; Osler,¹² ten to fifteen days; Holt¹² fourteen to sixteen days; Mitchell⁵ fourteen days; Jeans⁴ fourteen days; Coker⁴ fourteen to sixteen days; Cee,¹⁰ "At about a fortnight"; Thomas⁴ thirteen to seventeen days; Dalpech⁶ twelve days; Collett⁶ ten to nineteen days; Schramberg⁶ fourteen to seventeen days; Woods⁷ eleven to twenty-two days; Dock⁸ ten to twenty-one days.

Quoting from Sherman:⁷ "The older authorities declared that the period of incubation lasted from four to six days. Steiner by inoculation, demonstrated it to be eight days. More recently with the infection traveling in ordinary ways it has been considered to vary from eleven to twenty-five days but is oftenest fourteen to sixteen days."

Schramberg⁶ says the earliest age at which varicella has been observed and recorded is the one reported by Senator who saw an infant of eleven days with the disease.

S S Woodv¹ believes chickenpox occurs rarely before the sixth month of life, although instances are recorded of newborn infants developing the disease as early as the eleventh or fourteenth day, having been infected from the mother.

Lereboullet and Moricand² have reported a case in an infant whose mother had chickenpox before the child was born. The infant did not develop the infection until the fourteenth day after birth. Grulee³ believes that this case was one in which the child was infected by the mother, but that the infection was *not*, in all probability, transmitted in utero.

Pridham,² in 1913, reported the first case of congenital chickenpox. His patient was born with the typical eruption of varicella present, the mother having had the disease fourteen days before her confinement.

This case is reported because it illustrates a common error in diagnosis. It brings up the question of incubation and inoculation periods which modern authorities believe to be about fourteen and eight days, respectively. It is seemingly the earliest instance on record of the occurrence of chickenpox in a normal newborn infant. (Pridham's² case being one in which the eruption was present at birth, Senator's⁶ patient developed the disease on the eleventh day.)

Lastly, it is confirmatory evidence, if not proof, that congenital chickenpox may occur.

We wish to express our appreciation of the time and advice given us by Mr Asa Bacon and Mr Herman Hensel, Superintendent and Assistant Superintendent of the Presbyterian Hospital, Chicago.

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Pediatric Clinics

THE PEDIATRIC CLINIC OF THE YALE UNIVERSITY SCHOOL OF MEDICINE

GROVER F. POWERS, M.D.*
NEW HAVEN, CONN.

THE Pediatric Clinic of the Yale University School of Medicine comprises the Department of Pediatrics of the University and the Pediatric Service of the New Haven Hospital and Dispensary. The Clinic has special liaison with the Department of Lacholatory and Mental Hygiene and the Clinic of Child Development of the University, and with the Children's Community Center of New Haven (a child placing agency with extensive foster home and institutional facilities for convalescent children) and with the U. S. Children's Bureau.

HISTORICAL

The Medical Institution of Yale College, the parent organization of the present school, was formally opened in 1817 and in order of seniority is the fourth extant medical school in the United States. Teaching in pediatrics was inaugurated early possibly from the very beginning with lectures by Eli Ives, M.D., "Adjunct Professor of Materia Medica and Botany" in the original faculty. In 1820 Ives became "Professor of Materia Medica and Botany and Lecturer on Diseases of Children" but he had taught the subject prior to this time for there are extant under date of 1816 notes by a student on Ives' lectures on diseases of children. Later teaching in diseases of children was added to the duties of the incumbent of the professorship of "Obstetrics" which in 1868 became "Obstetrics and Diseases of Women and Children."

However it was not until 1896 the year that the Medical Institution of Yale College became the Yale Medical School, that under "Course of Instruction" there was inserted in the school announcement a special notation concerning children. It appeared in the outline of the teaching in "Obstetrics and Diseases of Women and Children" and was as follows:

Diseases of Children. This important branch of medicine is taught by didactic lectures and recitations as well as by clinical instruction at the Dispensary and Hospital.

In the bulletin of the Medical School for 1898-99 there appeared the following announcement under "Course of Instruction for the Senior Year":

'*Pediatrics.* Recitations 1 hour first term Professor De Forest

Clinic, 1 hour throughout the year with section work second term. Dr. Bishop, Dr. De Forest was "Clinical Professor of Medicine" and Dr. Bishop was Assistant in Pediatrics. This paragraph is noteworthy for the appearance of the title "Pediatrics," and the indication that the work with children had been transferred from the chair of "Obstetrics and the Diseases of Women and Children" to that of the "Theory and Practice of Medicine."

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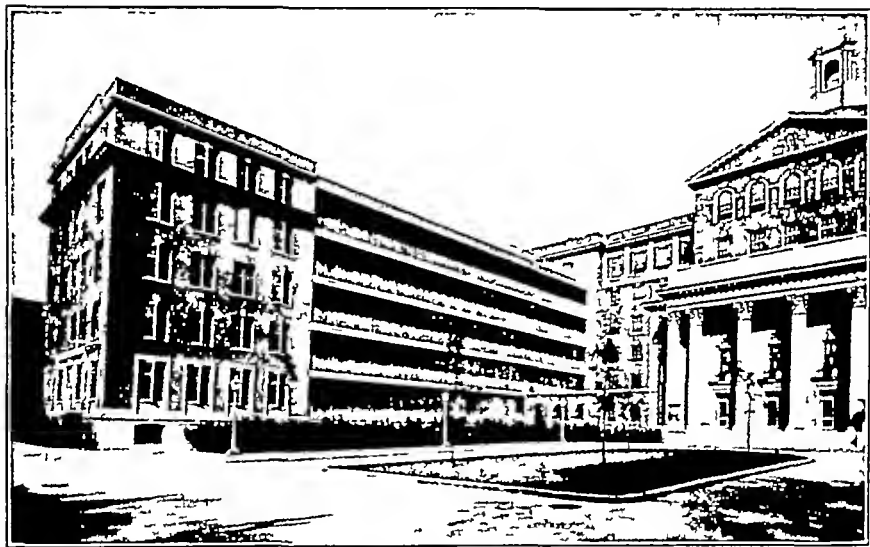
†Jacob introduced bedside teaching in Diseases of Children in New York in 1860.

Teaching and service in pediatrics remained a part of the functions of the Department of Medicine until 1921 when a separate Department of Pediatrics was created in the School of Medicine and a distinct Pediatric Service was organized in the New Haven Hospital, both under Professor Edwards A. Park.* Appointments to the hospital staff are made on nomination by the University.

The Hospital Service has the medical care of all patients under thirteen years of age, including newborn infants and children suffering from contagious diseases. Children on the Surgical Service are seen only on request. The Department of Pediatrics is one of five independent major clinical divisions of the Medical School and Hospital, these divisions taken as a group constitute the "Department of Clinical Medicine of the Graduate School of the University."

PHYSICAL FACILITIES

The New Haven Hospital was founded in 1826, but the present plant dates from 1930. The accompanying figure shows the plan of a portion of the third floor of the



The New Haven Hospital

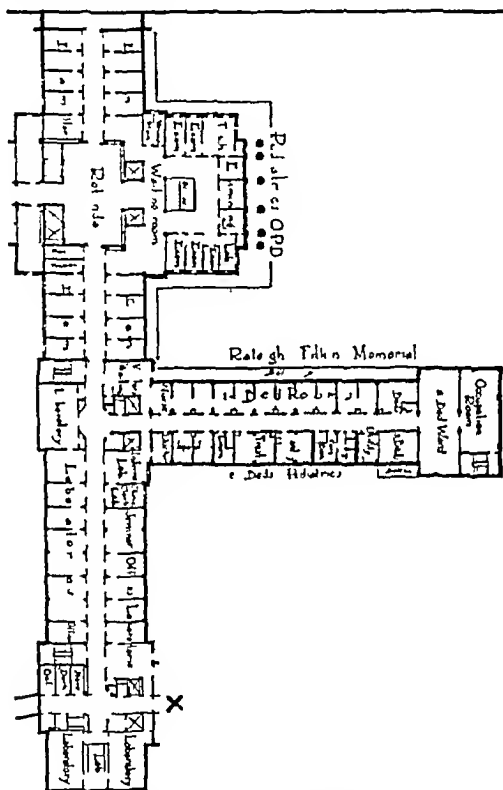
Hospital. The third floor of the central building of the medical pediatric pavilion (The Raleigh Fitkin Memorial Building) and of the Laboratory for Medicine and Pediatrics are assigned to Pediatrics, also, the fourth floors of the Fitkin and Laboratory buildings. These facilities thus constitute a compact, two floor unit. Plans for the ultimate development of the Pediatric Clinic call for the use of both of the present wards for noncontagious cases and the construction of two similar wards for contagious cases at the point marked "X" on the floor plan. The wards and laboratories will then constitute the third and fourth floors of an open quadrangle, with the Out Patient Division in physical continuity on the third floor of the adjoining building.

The nursery for newborn infants is in the maternity ward which is on the fourth floor of the surgical obstetric pavilion, this pavilion is on the southeast side of the

*Dr. Park resigned in 1927 to accept the professorship of pediatrics in the Johns Hopkins University.

main, central building in a position corresponding to that occupied by the medical pediatric unit. Six hundred and fifty infants were born on the Obstetric Service in 1973.

The Milk Preparation Laboratory is on the sixth floor of the central building in horizontal contiguity with the dietetic laboratories and the main kitchen of the



The Yale Medical School

Floor plan of portion of third floor allocation to Department of Pediatrics (similar allocation on fourth floor excepting Out Patient Department)

Hospital, and directly above the pediatric wards. The preparation of milk mixtures is under the supervision of a special dietitian, who gives instruction to clinical clerks on the preparation and costs of special foods for infants.

The Out Patient Division is physically and medically integrated with the other aspects of the work of the Clinic. The division has a full time medical director

the social service worker and Supervisor of Nurses for Pediatrics are the same for wards and dispensary. Each interne while on ward service sees his own discharged patients when they return to the Dispensary, a measure of medical continuity for such patients is thus attained. Each child with his parents or guardian is assigned his own examining room. By this arrangement privacy, self respect, control of contagion, more adequate, intimate teaching are fostered and facilitated. Clinical laboratories for physicians and clinical clerks, and special rooms for treatment and for group demonstrations are available. The physician in charge, the head nurse and the social worker have private offices. A large waiting room is not needed because patients come by appointments, which are arranged in staggered order. Morning hours are given over to general cases and afternoon periods to special clinics. There were 12,000 visits to the Pediatric Out Patient Service in 1933.

At the entrance to the wards, in connection with the head nurse's office, are waiting rooms for parents and other visitors. Across the corridor is the doctor's office contiguous with his clinical laboratory and that of the clinical clerks.

The balconies with southern exposure are easily accessible for all patients through triple sashed windows. The rooms marked "separation" are air conditioned for the care of premature and feeble infants. The single rooms are available for infants and for very sick older children. The larger units afford opportunity for companionship among the patients. Running water is available in all units, and the first four single rooms are equipped with toilets so that they may be used as "observation" rooms for newly admitted patients.

The usual capacity of the wards is from twenty five to thirty patients. The number of beds assigned to infants and to children is not fixed but fluctuates according to demand. In 1933 there were 335 admissions on the infectious disease service and 239 on the noninfectious service.

Private patients are cared for in a special pavilion built for such patients, children and adults alike.

The room marked "seminar" is The Pediatric Study, a simply but attractively furnished library and sitting room, which is the physical center of the Clinic. The equipment was the gift of women physicians connected with the Department, 1921-30. The study contains the department library of reference books and current journals.

The room marked "laboratory" at the end of the ward is a large teaching room where student and staff conferences are held. A large amphitheatre is located on the first floor of the Medical and Pediatric Laboratory.

The laboratories for research and routine studies on the third floor are equipped for chemical investigations while those on the fourth floor are designed for bacteriologic work. On the roof at the end of this floor is a penthouse which contains animal rooms with outside runways.

Studies involving roentgenographic, electrocardiographic, and postmortem examinations are carried out in collaboration with the departments in which these techniques have been developed. In 1933 there were autopsies on twenty four newborn infants and on fifty two other children.

STAFF

At the present time the Staff consists of thirty physicians. Six of these are salaried and devote their time to work in the University and Hospital, fourteen give part time service to the Clinic on a voluntary basis, ten are members of the house staff, whose appointments are for one year.

Technical assistance is provided in both the chemical and bacteriologic laboratories.

Of the salaried physicians, one has charge of the bacteriologic laboratory in the department and another of the chemical laboratory. These, with some of the others

to this group (including a Fellow) are engaged primarily in investigative work, with limited administrative and clinical responsibilities.

The policy of having department laboratories of bacteriology and chemistry instead of a central hospital laboratory is worthy of comment. The men who head these departments have direct clinical interest and responsibility for the patients on whom bacteriologic and chemical studies are done. As a result there is close correlation of clinical findings, laboratory data and therapeutic procedures. Scientific inquiry is stimulated in this way and the members of the house staff are encouraged to become acquainted with routine laboratory procedures and with the interpretation and significance of more elaborate studies. By way of illustration it is felt that the house staff should be able to do certain chemical procedures such as blood sugar determinations and should know the technique of plating and examining bacteriologic cultures such as are taken from throats, spinal fluids, and blood. Laboratory assistants, as well as physicians are available for guidance of junior men.

There are six internes on the house staff; they rotate in their experience and responsibility. The allocation of time is as follows: infectious disease ward four months (two physicians), noninfectious disease ward four months (two physicians), out-patient service (including work in the Nose and Throat Clinic) and nursery for newborn infants, two months (one physician) and Children's Community Center, two months (one physician). When on the latter service the interne has charge (under a resident who is also a member of the department staff) of cottages for convalescent and crippled children and makes house visits to children in foster homes. Also on this service, routine health examinations are made, and various preventive procedures performed.

Preferably, internes are chosen from men and women who have just graduated from medical school, but no fixed rule is followed.

The senior assistant resident has a year's service as assistant to the physician in charge of the Pediatric Out-Patient Service. The two junior assistant residents alternate in charge of the infectious and noninfectious service.

The resident has general medical supervision of ward patients and administrative and teaching responsibilities.

Time and opportunity are available for investigative work by members of the house staff particularly the assistant residents who are interested and qualified.

The physicians who give their services on a voluntary basis make contributions of inestimable value to the Clinic. In addition to dispensary work and to ward and office teaching of students of the graduating class these physicians bring special contributions to the department notably the point of view and procedure of the private practitioner. One clinical professor is medical director of the infant welfare conferences of the local visiting nurse association and another clinical professor has a similar relationship to the Children's Community Center. These relationships give the Clinic close affiliation with highly important health organizations. Other members of this group have important positions on other health and social welfare activities of New Haven and Connecticut.

A noteworthy feature of the department is the cooperation with the Department of Psychiatry. A psychiatrist specially trained in both pediatrics and psychiatry assists in the understanding and treatment of children with behavior problems. This physician attends pediatric conferences and teaches students in certain of the courses in the Department of Pediatrics. A similar liaison exists with the Clinic of Child Development. Developmental studies as indicated are made on patients on the Pediatric Service, and assistance is rendered in interpreting certain psychologic and developmental phenomena. The Nursery School of the Clinic of Child Development is available for observation and treatment of certain children.

The department has cooperated actively with the Children's Bureau of the U S Department of Labor in neonatal and rickets studies. Professional members of this staff have offices in the department, they share in clinical work and in teaching, paying special attention to the aspects of pediatrics in which they are making studies. These responsibilities are of value to investigator, Clinic and student alike.

NURSING

The Nursing Service of the Clinic in all divisions is under the Supervisor of Pediatric Nursing so that coordination and integration of all pertinent nursing activities are fostered. The Pediatric Wards are sufficiently staffed, so that it is possible both to give adequate nursing care to sick infants and children and to carry out the principles of child management and habit training, which are advocated by the Nursery School and Clinic of Child Development. The appointments for patients in the Dispensary are under the Nursing Service. The supervisor is an instructor in the School of Nursing and teaches medical clerks in certain aspects of child care and treatment. Similarly, instructors in the Department of Pediatrics share in the teaching of students in the School of Nursing. The instruction of parents in child care is a cooperative function of the Nursing and Pediatric Services.

SOCIAL SERVICE

The Pediatric Service has the cooperation of medical social service as an integral part of its work. Cases for social study and treatment are referred by the physician to the medical social worker, and thereafter frequent conferences between the social worker and the physician are held in order to correlate the medical and social care of the patient. The social worker makes regular rounds with the house staff and attends conferences on discharged patients. Social summaries are placed by the social worker in the unit medical histories giving what social data might be helpful to the physician. Students have contact with social workers in the Dispensary and in special conferences described later.

Under Medical Social Service and the Nursing Service are volunteers who carry out special follow up work on cardiac cases or recreational work for children, either on the ward or in the clinic. This latter work is done by a group of interested women comprising the Children's Recreational Committee, through its activities, occupational therapy, recreation, and good cheer are brought regularly to many sick children. Birthdays and other holidays are especially recognized.

The New Haven Department of Education details to the clinic a special teacher who gives instruction to appropriate cases during the year.

UNDERGRADUATE INSTRUCTION

During their first clinical year students serve ward clerkships (morning session) for five weeks in pediatrics. Daily ward conferences during that period in which the senior staff participates are not primarily concerned with bringing pediatric problems to the fore but rather, by "joining in" with instructors from other departments, in focusing attention on fundamental principles of clinical medicine. Attempt is made, however, in cooperation with the Supervisor of Pediatric Nursing, to teach the techniques of infant and child care and some of the more common procedures used in treatments of various types.

In the second clinical year, the year of graduation, emphasis is placed on problems peculiar to the developing child. Students serve clerkships (morning session) for five weeks in the Dispensary. During this period they also attend daily conferences on ward patients. For the most part these conferences are conducted by attending physicians who practice pediatrics in the community. These physicians take the group of students for a week (one hour daily), sometimes the students are taken to the office of the practitioner. All of these physicians do not participate in

the teaching of any one group of students but each group has a week of conferences with the physician interested in diseases of the newborn and a week with the instructor from the Department of Psychiatry who is specially interested in the behavior problems of children.

One hour each week also is given to a conference with the Director of the Social Service Department of the Hospital and the social worker attached to the Pediatric Service in conjunction with the physician in charge of the Pediatric Dispensary. The students and the social worker present selected cases for discussion primarily from the angle of social adjustment.

There is a weekly clinic at which various pediatric problems are discussed and illustrative cases presented. These clinics are attended by students in both clinical years.

The work just outlined constitutes that usually designated "required" in addition, elective courses in pediatrics are offered most of which are open only to students of the second clinical year. There is a seminar course in physical and mental development of infants, their metabolism, nutrition and feeding and in diseases of the newborn. The course is one hour per week throughout the academic year. The discussions on mental development are given by the Director of the Clinic of Child Development. There are two shorter seminar courses, one in clinical bacteriology and the other in infectious diseases. There are elective dispensary courses in infant welfare, in tuberculosis, allergic conditions, syphilis, diseases of the newborn, of metabolism and of the heart.

Before graduation students are required to present a thesis. The work described in the thesis is done in one or another of the departments of the Medical School. The Department of Pediatrics shares of course in giving direction and leadership in this work to a certain number of students. Much of the work is published.

GRADUATE INSTRUCTION

The policy of the department in respect to graduate instruction is that the most satisfactory means of acquiring facility in the practice of pediatrics is through the discipline of internships and residencies on a Pediatric Service. The department, however, fosters contact with practicing pediatricians who are invited to the weekly clinics. At special "rounds" once a week and at the weekly conference on discharged cases visiting physicians are specially welcomed. Many physicians from the city and from various parts of the state attend these exercises. Properly qualified physicians who wish pediatric training may work in the Clinic to the extent that facilities permit.

A University Children's Clinic has responsibilities and opportunities in many kindred fields of activity. Advancement of knowledge must be fostered and developed, students taught and given guidance and neighborhood physicians assisted and encouraged. The Clinic must share in the training of nurses and the development of hospital social service. Community contacts and responsibilities in health and social welfare activities must be welcomed. The care and treatment of the children who come to the Clinic must be sympathetically and understandingly given according to the highest standards of current knowledge and with the total situation of child, home, and parents ever in mind. To train young physicians to carry forward these ideals is perhaps the supreme function and opportunity of a Clinic.

For any clinic to live up to its purpose and its opportunities requires, in the words of Francis Peabody, "less of the system and law that kills and more of the spirit that gives life."

Critical Review

VITAMIN D MILK—A RÉSUMÉ

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BOSTON, MASS

INTRODUCTION

ADVANCES in our knowledge of vitamins, especially the fat-soluble vitamins, have been outstanding in the realm of nutritional problems. Less than a decade has passed since the first efforts toward augmenting the natural vitamin D content of milk were initiated. During these few years great strides have been made in both the comparatively simple problem of producing what is now termed "vitamin D milk" and in the more complex one of determining to what physical or physicochemical changes this addition to our antirachitic armament owes its potency. The rapidity with which these advances have been made, the never-ending succession of theory evolved, and facts determined, make a complete knowledge, understanding, and proper evaluation of the subject somewhat difficult for the practicing clinician. Consequently, it was felt that a résumé of the work that has led up to our present vitamin D milk and its clinical application might be of value.

Cow's milk, the chief dietary substance of artificially fed infants, has been endowed with a number of virtues by a kind Providence, but it does exhibit a few deficiencies, one of these is a relative lack of the antirachitic factor, vitamin D. Consequently, rickets has always been an extremely common condition in infancy and childhood and even in recent times, in spite of our newer knowledge of nutrition and increasing number of antirachitic medicinal agents, has been and is fairly prevalent due either to the failure to offer antirachitic substances to babies or to the offering of insufficient amounts of these substances. Thus, a milk in which the vitamin D content is sufficiently high to afford complete protection against rickets is, a priori, distinctly advantageous inasmuch as it represents an automatic form of prophylactic therapy.

Efforts to augment the natural vitamin D content of cow's milk have thus far included

- I Direct irradiation of the milk
- II Feeding of vitamin D concentrates to cows
- III Irradiation of cows
- IV Direct addition of vitamin D concentrates to the milk

I DIRECT IRRADIATION OF MILK

In 1924 Alfred Hess¹ announced to the American Pediatric Society his discovery that antirachitic properties could be imparted to certain substances by exposure to ultraviolet irradiation. The value of

light rays in the treatment of rickets had suggested to him the problem whether exposure of inert substances to ultraviolet rays could endow them with antirachitic potency. Consequently various fluids were subjected to irradiation. Cottonseed oil was exposed in a Petri dish for one hour at a distance of one foot from a mercury vapor quartz lamp and was then fed in amounts of 0.1 and 0.25 cc daily to rats on a standard rachitic diet. Control animals were given nonirradiated oil. It was found that the oil that had been irradiated required properties which protected the rats against rickets while the control animals developed the disease in the usual manner. Similar results were obtained when linseed oil was irradiated. The rats which were protected showed a serum inorganic phosphorus content of 6.84 milligrams per cent in comparison with 1.22 milligrams per cent in the rachitic controls. Irradiated mineral oil in contradistinction to cottonseed and linseed oil failed to offer any protection. At that time Hess felt it was too early to discuss the nature of the change brought about in these fluids which imparted to them the antirachitic potency.

Hess^{2, 4} then proceeded to investigate whether the same results could be obtained in growing plants whether similar differences could be demonstrated between vegetables and plants grown in the dark and those grown in the light and subjected to irradiations from a mercury lamp. These problems were subjected to experimental analysis. Wheat was grown in the laboratory both in darkness and in light with irradiation given daily for one hour. The wheat was then fed to rats in daily amounts of ten grams in addition to the routine rachitic diet. The rats receiving the wheat grown in darkness (etiolated) developed rickets while those ingesting the irradiated wheat were protected.

Similarly and to rule out any role or factor that differences in growth might play, ordinary plucked lettuce leaves were irradiated and fed in similar amounts to rats. The same result was obtained as with wheat: the irradiated leaves prevented rickets while the nonirradiated lettuce failed to offer protection. Thus an antirachitic factor was produced, by irradiation, both *in vitro* and in the growing plant.

Hess' work was closely followed by that of Steenbock^{5, 6} who demonstrated that growth promoting and bone-calcifying properties could be imparted to rats' rations by exposure to the quartz mercury vapor lamp. When the ration was irradiated at a distance of about two feet for ten minutes it produced the same effect as when the animals were irradiated directly. This activation took place whether the ration was irradiated in an open dish or in a quartz flask but not in a brown glass bottle. The potency was not subsequently destroyed by subjecting the food to a vacuum heating at 96° C. for forty five minutes or allowing to stand for twenty four hours. (It was later demonstrated that irradiated olive oil could stand for ten months without losing its potency⁷.) The previous observations of Goldblatt and Soames were also confirmed when it was demonstrated by feeding experiments that tissue such as lung, liver or muscle taken from directly irradiated animals had antirachitic properties. Furthermore, such tissue could also be endowed directly with growth promoting and bone-calcifying properties by exposure to ultraviolet light. Protection against rickets in the animals receiving the irradiated substances was not only judged by clinical standards but was confirmed by histologic sections⁸ and by chemical analysis of bones. The femora of control animals showed

an average ash content of 47.2 per cent while those of the animals receiving irradiated rations had an average ash content of 53.9 per cent.⁶

The number of substances capable of activation by irradiation was further amplified and included such diverse materials as ^{9, 10, 11} vegetable oils, wheat, corn, flour, yeast, egg yolk, butter, plants and vegetables, animal tissues, and what is of especial interest for our immediate discussion, milk. Thus a firm foundation was laid for further experimental and clinical work.

The knowledge that experimental animals could be protected against and cured of rickets by the ingestion of irradiated food, including milk, was soon put to clinical application. Cowell¹² was probably the first to give a clinical report on the feeding of irradiated milk to infants. Three young children, from one and a half to two and a half years of age, with active rickets were the first human subjects. They were given a diet whose only antirachitic value lay in the daily ingestion of a pint of milk. The two infants who received irradiated milk (exposed for twenty minutes at a distance of three feet from a mercury vapor lamp) showed definite improvement at the end of four weeks. The third infant, who acted as a control and received nonirradiated milk, showed no change. Kramer¹³ followed shortly thereafter with another more careful clinical analysis. Irradiated milk was given to eight rachitic infants. Kramer's method of irradiation consisted of pouring the milk into a large shallow dish and irradiating with a mercury vapor lamp at a distance of two feet for not more than two hours. He felt then, however, that the time was probably excessive and could be reduced to ten or twenty minutes.¹ (This emphasizes the differences in technic of irradiation of a few years ago and of the present day which will be discussed shortly.) In the children receiving the irradiated milk, healing of rickets was demonstrable by the third week and was usually well marked by the fourth week. The phosphorus content of the blood was raised, reaching a normal level about the fourth week of treatment. Control patients, who were on the same diet save for lack of activation of the milk, showed no improvement. Gyorgy¹⁴ gave the first German report on the efficacy of irradiated milk in the treatment of rickets. Irradiated milk was given to eighteen children with florid rickets with marked improvement in sixteen, judging by clinical, blood, and x-ray findings.

Some of the more important references to articles that followed later are appended.¹⁵⁻³⁵ Most of the reports attested to both the prophylactic and curative efficacy of irradiated milk although many investigators found it to be a somewhat slower curative agent than viosterol.³⁶⁻³⁸ In Germany especially, due to the naturally low vitamin D content of the milk produced there, a good deal of investigative work has been done with this antirachitic agent and an abundance of clinical reports has emanated from that country.

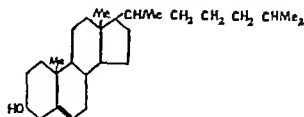
With the clinical value of this type of milk definitely established, further advances in this country have consisted chiefly in improving methods of irradiation. Much of this work has been done by Supplee and his associates.³⁹⁻⁴² A full analysis of the physics, energy quotients, and mechanical difficulties involved would be unnecessary for a medical discussion. Suffice it to say that the wave lengths of the rays which have proved efficient in the irradiation of milk and other substances are of

the magnitude of 300 $\mu\mu$ or 3 000 Å. Rays above 313 $\mu\mu$ in length are of practically no value. It makes but little difference whether the source of the ultraviolet rays is in the form of an arc (such as carbon or magnesium) lamp or a quartz mercury vapor lamp provided comparable amounts of energy are used. Suppiger has shown that the degree of antirachitic potency imparted to the milk bears a direct relationship to the amount of energy (in ergs) applied up to a certain limit beyond which further increases in energy applied increase the vitamin D content but little. The efficiency of the reaction is probably greatest during the first few seconds of exposure. The present method of irradiation consists of uniformly exposing the milk in the form of a moving film which receives rays from carbon arc lamps at constantly changing angles of incidence varying from 0 to 90°. The thickness of the film of milk is about 0.1 mm and the time of exposure does not exceed sixteen seconds. Each cubic centimeter of milk receives about two and one half million ergs of radiant energy. The resulting formation of vitamin D represents a large percentage of the maximum obtainable yet the exposure is so short as not to cause detectable changes in taste or smell or vitamin A content. Scholl in Germany has devised a system of irradiating the milk in the presence of an atmosphere of carbonic acid gas in order to avoid changes in taste and smell but with the present short exposure this seems unnecessary.

What chemical physical or physicochemical changes are brought about by the irradiation of milk or other substances that enable them to assume antirachitic properties? How can we correlate two such utterly different factors as vitamin D and ultraviolet rays? The answers to these questions, while not as yet fully complete have been built up on a series of painstaking experiments evaluated by the clear logic of several brilliant workers.

It may be recalled that Hess in his early experiments was able to endow a large number of seemingly heterogeneous substances with antirachitic powers. The question immediately arose whether the irradiation per se was the prime factor in the activation. It was known that ozone was formed when the ultraviolet lamps were used and in order to rule out this substance as the causative agent of antirachitic potency, ozonated water was fed to rachitic rats. There was no improvement in their condition. Similarly hydrogen peroxide might be formed but it too was found to be devoid of any antirachitic value. It was then shown by fractionization of vegetable oils as Zacker¹³ had previously demonstrated in cod liver oil that the active irradiable principle was present only in the nonsaponifiable portion of the oil.¹⁴ This principle was shown to be a sterol, presumably cholesterol. Rosenheim and Webster¹⁵ also found that cholesterol could be activated and endowed with antirachitic properties. Substances rich in cholesterol, such as skin, could be rendered highly antirachitic.¹⁶ That the resulting change was probably a simple chemical or physicochemical one rather than a complex biologic process was attested to by the fact that detached skin obviously entirely deprived of connection with nervous or circulatory system, could be irradiated and rendered antirachitic.¹⁷ In the plant world, where there is no cholesterol, it was demonstrated that the sterol corresponding to cholesterol in the animal kingdom is phytosterol.

Cholesterol, it seemed then, was the primary substance which in some way was changed during the process of irradiation and, with this metamorphosis, assumed antirachitic properties. Cholesterol, it may be stated, is an optically active unsaturated sterol whose structural formula, while not definitely settled, is probably represented by ⁴⁷

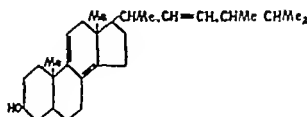


Of particular interest is the presence of the hydroxyl group and the double bond between two carbon atoms. The presence of both of these has been shown to be necessary for activation by irradiation. Thus, compounds in which the double bond is saturated by hydrogenation, i.e., dihydrosterol cannot be activated.^{10 48 49} Nor can compounds in which the hydroxyl group is replaced by other groups, i.e., cholesterol chloride,⁵⁰ be activated. (Strictly speaking, this is not absolutely true as the esters of cholesterol, such as cholesterol acetate, have been activated, but this is probably due to the fact that the esters are very easily hydrolyzed thus restoring the hydroxyl group.^{51 52})

However, the work was still by no means completed. It was found by Hess and Windaus⁵³ and Rosenheim and Webster^{52 54} that highly purified cholesterol lost its power of assuming antirachitic activity on irradiation. They felt, then, that there was some contaminating substance closely associated with cholesterol to which the latter owes its activity. This had been previously suspected by Zucker⁴³ and by Steenbock.⁹ It was found that when this contaminating substance was separated and irradiated it had a potency at least 500 times that of irradiated cholesterol.⁵⁵ In the meantime, Hess and Windaus, experimenting with a large number of cholesterol derivatives found that only ergosterol was capable of being rendered antirachitic by irradiation.^{56 57}

As may be suspected the contaminating substance intimately associated with cholesterol and ergosterol are one and the same. It seems at present that ergosterol is the only substance capable of assuming antirachitic properties during the process of irradiation. All substances owe their power of becoming antirachitic following irradiation to the contaminating presence, in minute quantities, of ergosterol, which apparently is the precursor of vitamin D.

Ergosterol is a sterol closely related to cholesterol but containing three unsaturated double bonds and may probably be represented by the formula ^{47 58}



Exactly what happens during the process of irradiation is not yet definitely known. Oxidative changes are ruled out by the fact that irradiation is equally successful in producing antirachitic potency in an atmosphere of nitrogen. Probably no chemical change per se takes

place as following irradiation the melting point optical rotation and composition according to analysis remain unaltered.² There has however, been demonstrated a definite alteration in spectral absorption.³ Hess² felt that some isometric change took place on irradiation. Wejdling,⁴ believing that the crystalline structure of ergosterol might be changed in the process of activation felt that the change should be demonstrable by measuring the change in the distance between atoms *in vacuo* by means of x rays. He found instead that at the moment of strongest activation no crystalline structure was left that as soon as ergosterol was transformed by irradiation into the vitamin the atoms lost their regular arrangement. This may explain why once the substance is overexposed to ultraviolet irradiation it loses its activity and can never be reactivated.

To recapitulate substances including milk which can be rendered antirachitic by irradiation owe this property to the presence of varying contaminating amounts of ergosterol which is the forerunner of vitamin D. It is the only substance which has thus far been definitely shown to be capable of activation. Precisely what physical or physicochemical change takes place on irradiation is not yet known.

II. FEEDING OF VITAMIN D CONCENTRATES TO COWS—YEAST MILK

In the early stages of the work on vitamins Funk advanced the suggestion that the secretion of these factors in milk was controlled by their presence in the food of the lactating animal. However it was not until a number of years had passed before attempts were made to increase the vitamin D content of cow's milk by the addition of large amounts of vitamin D to the cow's diet.

In 1924 Lesne and Vigliani⁵ added 500 gm. of cod liver oil daily to a cow's feed. When tested experimentally the milk produced showed increased antirachitic potency exhibiting good curative and protective powers against rickets. The following year Wagner⁶ could demonstrate no increase in the antirachitic potency of milk of cows fed from 50 to 300 gm. of cod liver oil daily. Golding et al.⁷ however, felt that the addition of 8 ounces of cod liver oil daily to a cow's winter ration did raise the antirachitic potency somewhat. The addition of 2 ounces daily had no demonstrable effect.⁸ Failure to increase the vitamin D content of cow's milk by the addition of cod liver oil to the feed may well be explained by the fact that such large doses as are necessary decrease markedly the fat moiety of the milk in which the antirachitic factor lies.

Similar experiments were being conducted about the same time on humans. Hess fed cod liver oil to both pregnant and lactating women in an attempt to supply additional vitamin D to the young. The results were disappointing and Hess concluded that rickets in the offspring could not be prevented by improving the mother's diets either during pregnancy or lactation.^{9, 10} Weech¹¹ performed a similar experiment on a group of lactating mothers (colored) and thought that while the administration of cod liver oil to the lactating mother is not a satisfactory method of preventing rickets in the young a certain amount of additional antirachitic substance does pass into the milk effecting a rise in the serum calcium phosphorus product in the infant and lessening x ray evidences of the disease. Gerstenberger's¹² efforts to increase the vitamin D content of the milk of wet nurses by

feeding them a half ounce of cod liver oil daily resulted in failure. Thus we see that the addition of vitamin D in the form of cod liver oil to the diet of lactating animals—both bovine and human—proved, on the whole, unsuccessful.

However, with the introduction, within a few years, of such highly potent vitamin D concentrates as irradiated ergosterol and irradiated yeast, success seemed more imminent. Eufinger et al.⁷³ were the first to increase satisfactorily the vitamin D content of human milk by feeding vitaminol (irradiated ergosterol) to lactating mothers. After only a few days of this supplementary feeding both the colostrum and milk became highly antirachitic. Similarly, Gerstenbeiger⁷⁴ gave 15 mg. of irradiated ergosterol daily to wet-nurses. Rachitic infants who received from one pint to one quart of this milk daily showed rapid healing. He felt that a daily dose to lactating mothers of from 2 to 3 mg. of irradiated ergosterol would be adequate to give their milk good antirachitic properties.

Wachtel⁷⁵ was the first to feed irradiated yeast to cows and thereby markedly increase the vitamin D content of the milk produced. His work was closely followed by the investigations of Steenbock and his coworkers.⁷⁶ Steenbock fed 200 gm. of irradiated yeast daily to cows. The milk produced showed high antirachitic potency as measured by feeding experiments with rats. While the femora of groups of rats on ordinary milk showed an average ash content of from 34 to 37 per cent, the bones of the animals on "yeast" milk showed an ash content of 52 per cent, demonstrating the marked calcifying properties of the "yeast" milk. When the daily amount of irradiated yeast was reduced to 10 gm., the resulting butter fat of the milk produced was naturally much less calcifying but was still superior to the butter fat produced on an unsupplemented diet. Steenbock felt that this amount of irradiated yeast produced about the same effect as the daily ingestion of 6 ounces of cod liver oil.

Thomas and MacLeod⁷⁷ conducted similar experiments on twenty-one cows divided into seven groups. One group was left on an unsupplemented diet as a control, the next three groups were given respectively, 10,000, 30,000, and 60,000 rat units of vitamin D in the form of irradiated yeast, and the last three groups were fed 15,000, 45,000, and 135,000 rat units of vitamin D in the form of irradiated ergosterol. The butter fats of their milks were then compared by feeding to rats on a rachitic diet and the antirachitic potencies measured by the line test. The relative potencies of the butter fats are shown in Table I.

TABLE I

RAT UNITS FED	RELATIVE ANTIRACHITIC POTENCY OF BUTTER FAT
Control	1
10,000 units as irradiated yeast	2
30,000 units as irradiated yeast	8
60,000 units as irradiated yeast	16
15,000 units as irradiated ergosterol	2
45,000 units as irradiated ergosterol	4
135,000 units as irradiated ergosterol	16

Krauss', Bethke's, and Monroe's⁷⁸ experience, with irradiated ergosterol only, proved to be similar. A study of the antirachitic poten-

cies of the butter fats of milk produced with increasing administration of irradiated ergosterol showed the following comparative values

RAT UNITS OF VITAMIN D FED TO COYS DAILY	CRITICAL DAILY LEVEL OF D F (TO PRODUCE DEFINITE EVIDENCE OF HEALING IN THE RAT)		RAT UNITS PER GM OF D F
0	600 mg		0.17
7,000	300 mg		0.20
15,000	200 mg		0.50
100,000	60 mg		1.67
200,000	30 mg		2.50

Thus, we see that according to their figures the antirachitic potency was increased approximately fifteen times by the daily administration of 200,000 units of vitamin D as irradiated ergosterol. Judging from Thomas and MacLeod's results and those of Hurdembergh and Wilson¹⁰ which follow shortly, these are really rather conservative increases.

The latter investigators fed irradiated yeast and irradiated ergosterol as supplementary vitamin D offerings. The ergosterol was fed in daily amounts of 100,000 and 200,000 rat units and the yeast in daily amounts of 30,000 and 60,000 rat units with the comparative increases in antirachitic potency as shown in Table II.

TABLE II

SUPPLEMENT FED	RAT UNITS OF VITAMIN D FED DAILY	AMOUNT OF D F CONTAINING 1 RAT UNIT	RELATIVE POTENCIES
Control		8.0 gm	1
Irradiated ergosterol	100,000	0.5 gm	10
Irradiated ergosterol	200,000	0.25 gm	32
Irradiated yeast	30,000	0.5 gm	10
Irradiated yeast	60,000	0.25 gm	32

Irradiated yeast seems to be the supplement of choice as it has proved to be about three times as effective as irradiated ergosterol on the basis of the number of rat units fed.

Clinical experiences with yeast milk (including in this term milk produced with either yeast or ergosterol supplements) have with rare exception been excellent although Gerstenberger's⁹ report on the clinical use of the milk produced in Krauss' feeding experiments seemed somewhat disappointing. Two rachitic infants who were given one pint of this milk daily (plus one pint of ordinary skimmed milk and sufficient carbohydrate to meet their caloric needs) showed rather slow healing. The bones of the two infants were not completely healed at the end of ten and eleven weeks respectively; the blood calcium levels became normal only after the tenth week and the serum phosphorus had not attained a normal value by the end of the experiment. Gerstenberger felt from comparative clinical experience with cod liver oil, that a pint of this fortified milk contained slightly less than half a teaspoonful of cod liver oil equivalence.

Other reports have definitely shown this milk to have excellent protective and curative powers. Hess and his coworkers¹¹ reported clinical

cal results on a group of 102 infants, many of them colored or Italian, who were given milk from cows fed 100,000 and 200,000 units of ergosterol and 30,000 and 60,000 units of irradiated yeast. This milk, as we have seen, is sixteen and thirty-two times as potent as ordinary milk, and assays 80 and 160 units of vitamin D, respectively, to the quart. All but the weaker yeast milk proved quite satisfactory from both the curative and protective standpoint. Two reports by Wyman^{82, 83} have been quite favorable. Kramer's and Gittleman's⁸⁴ experience with the use of a yeast milk treated so as to contain only 55 and 40 units, respectively, of vitamin D was eminently satisfactory from the curative standpoint.

III IRRADIATION OF COWS

The efficacy of exposure of the lactating animal to light rays as a means of increasing the vitamin D content of its milk has been both opposed and upheld. Luce^{85, 86} was one of the first to investigate the relative influence of diet and exposure to sunlight on the growth promoting and antirachitic properties of milk produced by cattle. She found that milk from pasture-fed cattle had a definitely higher antirachitic value than milk from cows that were stall-fed in the dark. However, it was found impossible, by means of sunlight alone, to raise the antirachitic value of the milk if the diet of the cows was deficient. She concluded, therefore, that exposure to sunlight plays only a minor subsidiary rôle in the production of vitamin D factors in the milk. Chick and Roscoe,⁸⁷ however, expressed the opinion, following experimental work, that while the diet was the important factor in the production of vitamin A, the degree of insolation played the more important rôle in the determination of the antirachitic potency of the milk produced. Supplee and Dow⁸⁸ found that summer milk contained somewhat higher amounts of vitamin D than winter milk. Again, it is difficult to evaluate the rôle played by the amount of sunlight and the type of food ingested during these two seasons. However, none of these opinions are of much aid in determining the extent of increase of vitamin D that might be expected from direct irradiation of the animal by means of a mercury vapor or carbon arc lamp, inasmuch as the sun's rays when they strike the earth are of but meager potency in the ultra violet range.

Steenbock⁸⁹ proceeded to irradiate an animal directly and used for this purpose a lactating goat. The hair was clipped closely, and the animal was irradiated daily. It was found that, while previously a daily ingestion of 12 c.c. of its milk was necessary to cause incipient calcium deposit in experimental animals, following irradiation (as early as four days after irradiation was begun) only 2 c.c. were required to produce the same effect.

Later and similar experiments with cows, however, produced entirely negative results.⁹⁰ Cows were exposed daily for one hour at a distance of from 20 to 30 inches from quartz mercury vapor lamps, various regions such as head, back and udders being irradiated. No demonstrable increase in the vitamin D content of the milk was obtained. We are at a loss to explain this negative result as practically all other investigators have been able to effect an increase in the antirachitic potency of the milk by direct irradiation of the lactating ani-

mal. Thus, Clowen et al.²¹ reported that definite curative powers were imparted to cow's milk by exposure of the animal's back to the ultra violet lamp for as short a period as fifteen or thirty minutes daily. Falkenheim²² was also successful in raising the vitamin D content by means of direct irradiation of the animal. Wagner and his coworkers²³ irradiated cows daily for one hour at a distance of 50 cm from the ultraviolet lamp. The milk thus produced was given to eight infants, six of whom were entirely protected against rickets and two a pair of twins began to show early craniotabes at the end of three months. It was felt that the milk was satisfactory for ordinary routine prophylaxis against rickets.

Attempts to raise the vitamin D content of breast milk by irradiation of the lactating mother have also proved successful. Hess²⁴ irradiated a lactating woman every other day for a month. Previously 25 c.c. of her milk fed to rachitic rats daily had failed to cause any improvement in their condition. Following irradiation the same quantity of milk caused definite improvement and raised the phosphorus content of the blood of experimental animals from an average of 1.98 mg. per 100 c.c. to 1.61 mg. per 100 c.c. (The phosphorus content of the milk itself was 1.04 found to be increased.) Hess pointed out that there was an increase in the nonsaponifiable fraction of the milk. (Cristenbarger²⁵ and Lesne and Dreyfus-Ser²⁶ have reported equally successful experiments.)

The latest report on the irradiation of cattle comes from Mitchell and his group.²⁷ Carbon arc lamps were arranged in the stalls so that each cow's udders were exposed on one side to the lamp for fifteen minutes daily. The lamps were at a distance of about two feet from the animals and were in this order:

Cow Lamp Cow Cow Lamp Cow Cow Lamp Cow

Biologic assays of the milk from irradiated animals showed the antirachitic potency to be approximately 22 rat units of vitamin D per quart as compared with 5 rat units of vitamin D per quart for ordinary milk. Feeding experiments with twenty-one infants over a six to eight month period showed that this milk had as good protective powers against rickets as directly irradiated milk.

IV. DIRECT ADDITION OF VITAMIN D CONCENTRATE TO THE MILK

Thus, the latest method of increasing the vitamin D potency of cow's milk has been reported by Zucker.²⁸ A concentrate of cod liver oil of high potency and purity furnished in the form of a "150 D" preparation, i.e., a preparation 150 times as potent as standard cod liver oil as measured by the Steenbock line test, is diluted in the proportion of one part in 12,000 parts of milk. This procedure results in a milk which contains approximately 150 units of vitamin D to the quart or the equivalent of about three teaspoonfuls of cod liver oil. The incorporation of the concentrate can be done by homogenization, partial homogenization, or by a third method not involving homogenization. There is no separation of the concentrate from the cream by any of these methods. The milk has been frequently assayed on rats with excellent results from both the curative and protective standpoint. Investigation by Barnes²⁹ with the use of the concentrate in infants has shown it to be a highly effective antirachitic agent, effecting in rachitic infants a return to normal of the serum calcium and phosphorus and the

x-ray findings within two weeks. One hundred and fifty units of vitamin D per quart has been selected as the amount which has seemed from clinical experience with cod liver oil to be a good prophylactic standard.

DISCUSSION

What should be stressed in a comparison of the relative advantages and disadvantages of these various methods devised for increasing the antirachitic potency of cow's milk?

Earlier objections to directly irradiated milk were largely due to errors of technic in irradiation. Thus such disadvantages as changes in taste and smell and destruction of vitamin A have been shown to be definitely attributable to overexposure to the ultraviolet rays. With the present exposure of only sixteen seconds, there is no detectable change in palatability or vitamin A potency.⁹⁹ Supplee and Dow¹⁰⁰ have demonstrated a slight but measurable loss in vitamin C potency in irradiated fluid milk but not in irradiated dried milk. Inasmuch as antiscorbutic factors are added routinely to the infant's diet, this slight loss of vitamin C is of practically no importance. This method, of course, does require additional apparatus and is applicable chiefly to centers with large pasteurizing plants. In smaller communities, the installation of such apparatus would hardly be commercially and financially advisable. However, as irradiated dried milk it may be shipped to all parts of the country and kept for several months without any loss in antirachitic potency.

In its favor is the fact that no special feeding or supervision of cattle is necessary. The milk is shipped as usual into the pasteurizing plant and the additional process of irradiation is easily and quickly performed at a cost of only a fraction of a cent per quart of milk. Any objection to the method because it involves further handling of the milk is met with the answer that far from the introduction of any contaminating process, the irradiation has been actually shown to lower markedly the bacterial count.^{20, 101, 102} The milk, following irradiation, has a vitamin D content of approximately 50 to 55 rat units which has seemingly proved ample for both curative and protective purposes.

The production of yeast milk involves special supervision and feeding of cattle and, because it is difficult to follow closely, due to the long experimental work involved, the potency of a milk supply whose vitamin D content is dependent on feeding operations carried on over scattered areas, is at present and probably for the near future limited to supervised dairy farms such as are now able to put certified milk on the market. These farms are, of necessity, limited to areas supplying large urban districts such as New York, Boston and Philadelphia. At present, the method is a good deal more expensive than the direct irradiation of milk. Krauss feels that the feeding method is a more natural procedure for increasing the vitamin D content of cow's milk. No further handling or treatment of the milk is necessary. No untoward effects on the cattle have been observed with continued feeding of the yeast or ergosterol.

Hess, in a comparison of the two milks, i.e. "yeast" and irradiated, was inclined to place the yeast milk second in point of efficacy because, in clinical experiments, the same results seemed to be obtained with irradiated milk which contains only about 50 units of vitamin D to the quart as with the yeast milk which contains 160 units of vitamin D.

to the quart. However Kramer²⁴ has shown that yeast milk treated so as to contain only 55 and 40 units, respectively of vitamin D to the quart is as efficacious as a curative agent as irradiated milk containing the same number of vitamin D units.

The direct irradiation of animals again involves special apparatus. Once installed however the actual process of irradiating an animal for fifteen minutes a day does not seem too involved. Close supervision as required in supplementary feeding does not seem necessary. We have again, however the same objection as with yeast milk, namely the difficulty in following closely the potency of a milk, whose vitamin D content in this case, is dependent on irradiation operations carried on over widely scattered areas. A little more clinical evidence as to its efficacy moreover seems indicated. The method resulted according to Mitchell in a milk having an antirachitic potency of only 22 units of vitamin D per quart which is only about four times that of ordinary milk. Whether this will be sufficiently protective under all types of circumstances remains to be corroborated.

The fourth method seems very simple and does not depend on special, controlled feeding of cows or on elaborate apparatus. Small pasteurization plants can carry out the procedure equally as well as large ones. The potency of the milk is definitely known beforehand and one does not have to wait for several weeks of animal experimentation to evaluate the potency. The chances for error are minimal as the whole procedure involves only the addition of a standardized previously assayed concentrate. While the procedure is probably more expensive than direct irradiation of milk, the price nevertheless is less than that of ordinary milk plus cod liver oil. The method does not have to be restricted to larger centers of population but can be used wherever there is a pasteurization plant.

There remains, finally, a question which has as yet not been satisfactorily answered. Hess was one of the first to place it before us. Why are fewer units of vitamin D in the form of vitamin D milk sufficient to protect against rickets than in the form of other antirachitic agents such as cod liver oil or viosterol? Hess²¹ compared the potency of yeast milk with that of cod liver oil and of viosterol in Table III.

TABLE III

INTAKE OF COW IN RAT UNITS	MILK (1 LITER) IN TERMS OF		
	RAT UNITS	VIOSTEROL (DROPS)	COD LIVER OIL (GM.)
Ergosterol 100 000	80	1	6
Ergosterol 200 000	160	2	12
Yeast 30 000	80	1	6
Yeast 60 000	160	2	12

He drew the conclusion that yeast milk is more comparable to cod liver oil than to viosterol for while 12 gm. of cod liver oil (corresponding to one liter of the 160 D milk) would be a fair daily prophylactic dose for infants 2 drops of viosterol would be highly inadequate. Hess then further demonstrated that one liter of milk, 15 cc. of cod liver oil, and 10 drops of viosterol are each sufficient as a daily dose to protect the average infant from rickets. If these figures are transposed into rat units we find the comparative potencies are 160 200 830 or in the

ratio of 1 1 25 5 2 The difference between the yeast milk and viosterol is striking, that between the milk and cod liver oil not so pronounced. However, Kiamer has shown that as little as 40 units of vitamin D in the form of yeast milk daily is sufficient as a curative agent in rickets. This would make the ratio 40 200 830 or approximately 1 5 21. Similar results have been recorded for irradiated milk, and numerous clinical reports attest to the efficacy of irradiated milk containing only 50 units of vitamin D per quart. As we have seen, the direct irradiation of cattle results in a milk which contains only 22 units of vitamin D per quart, and yet the milk has seemed to be an efficient protective agent. On reviewing earlier reports, we see that MacKay and Shaw¹⁰ effected healing of rickets in from two to three weeks with as little as 3½ ounces of irradiated dried milk or 5 ounces of irradiated condensed milk daily. This amount of milk probably did not contain even 20 units of vitamin D. Thus we have extensive clinical evidence to the effect that far fewer units of vitamin D in the form of vitamin D milk are required to protect against or heal rickets than is the case for other antirachitic agents.

Watson¹⁰³ has given us an interesting discussion of this problem. He states in part: "According to official biologic tests, the increase in the amount of antirachitic property in milk brought about by irradiation is, from the laboratory point of view, trifling in comparison with the large amount of vitamin D present in various irradiated medicinal substances. On the other hand, we have the striking fact that irradiated milk has been shown to cure rickets in cases which have failed to respond to the prolonged administration of irradiated commercial preparations in common use. What is the explanation of this anomaly? It is possible that irradiated medicinal substances may steadily lose their curative powers, milk having the advantage of being consumed in the fresh state. It is equally possible that irradiated milk possesses some property of value which is not determined by the present laboratory test for vitamin D. There is the further possibility of a tendency to err in thinking the results obtained from experiments in rats under laboratory conditions are capable of fairly rigid application to clinical conditions in the human subject. It is conceivable that the milk acts merely as a carrier of some specific energy imparted to it by suitable irradiation, this added property only coming into action in the tissues. In this event, it would be clear that its action is not the same as in the case of irradiated ergosterol where a definite physical change is effected in the ergosterol by the irradiation process." Watson believes we must come to the conclusion that some vital property has been added to the milk which is not represented by the present laboratory test for vitamin D. He proceeds: "In nature, vitamins are found only in the vegetable kingdom. Vitamins in animal tissues and in milk are derived from the vegetable foods consumed. The vital energy of the sun strikes the cells in the plant and in those cells the solar energy is transformed into a chemical vital energy which promotes the normal growth and development of the tissues in the vegetable kingdom. The activated tissues hold some of the original vital energy which initiated the chemical changes. Those tissues are in turn consumed by animals or man, to whom that energy is in turn transmitted as a so called vitamin. Thus solar energy is transformed in nature and by artificial means (ultraviolet lamp) into chemical energy. It is apparent that between the

chemical energy as it is stored up in the plant or substance and the sunlight energy which starts the process there must exist a very close kinship in nature if not indeed identity.'

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Round Table Conference on Upper Respiratory Infections

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DR ISAAC A ABT (CHICAGO ILL.)—Diseases of the upper respiratory tract are among the most frequent affections in children. This group of disorders occurs most commonly during the autumn winter and spring. Every practitioner has observed that in some instances colds spread through an entire family. Frequently they will affect many of the children in a classroom or spread through the entire school. In an infant asylum or in a babies' ward of the hospital infections of the upper respiratory tract with pulmonary complications may cause an alarming if not fatal, epidemic. Rachitic, allergic, as well as children of the so called lymphatic type are most frequently affected. In many of the infants and children predisposed to catarrhal affections, there seems to exist an indefinable and not thoroughly understood, constitutional factor.

In addition to this there are variable external factors such as temperature, air pressure variations in moisture, as well as in quantity and quality of solar rays. The intensity of the latter fluctuates at different seasons as well as in different geographic locations. It is well known that the ultraviolet radiation reaches its maximum during the summer and its minimum in the winter and that the intensity is greater in the autumn than in the spring.

THE COMMON COLD

The common cold has received the attention of medical men throughout the ages. The affections considered under this classification have been thought to be due to the effect of cold air on the surface of the body during a longer or shorter period. In a more restricted sense it was thought that the effect of cold air on the respiratory tract was capable of producing inflammatory reactions. With the discovery of microorganisms, the infectious nature of the diseases of the upper, as well as the lower respiratory tract, had its vogue, and the old notion of the effect of cold was discarded for a time at least. It is readily conceivable however, that cold air of itself may produce local effects on skin and mucous membranes, and these effects are to be observed in the narrowing of the superficial vessels with subsequent dilatation and congestive phenomena. We have only to think of local frost bites which are associated with marked inflammation without the presence of microorganisms. A sensitive child whose feet become chilled or wet will very frequently develop tickling in his nose with profuse discharge and if this manifestation recurs, after repeated exposure of a similar nature one may feel reasonably certain that there

is a relationship between the cause, wet feet, and the nasopharyngeal catarrh. Though modern authorities consider the cooling of the body a predisposing factor in a nonresistant individual, infection of some kind or another is the exciting cause. To show that cold of itself does not necessarily tend to produce the upper respiratory diseases, is elucidated by the experience of Nansen, the Polar explorer, whose men were exposed to the most severe cold in the Arctic.

Nono developed any catarrhal symptoms under these conditions. However, on returning to a more populated region many suffered from colds, coughing, and sneezing.

It has been suggested by De Rudder that certain meteorologic conditions affect the autonomic nervous system in such a way as to produce capillary contraction with subsequent local and internal hyperemia. But this assumption is altogether speculative and without further proof remains untenable.

In a recent paper by Dochez, Catherine C. Mills, and Yale Kneeland in the *Journal of the American Medical Association*, the etiology of the diseases of the upper respiratory tract are critically reviewed. These authors consider, in some detail, the organisms which have been thought to be etiologic factors in the production of the common cold. They point out that there is a "basal flora" of the upper respiratory tract composed of organisms which are generally thought to be nonpathogenic and of others that are supposed to be highly pathogenic. The presence of such organisms does not necessarily produce symptoms of infection of the upper respiratory tract. Indeed, even when the infection is in progress, these organisms may not be increased in number. When secondary inflammatory processes of the upper respiratory tract occur, the organisms may be shown to have increased in activity.

They have studied upper respiratory infections in infants and have found that the tract is sterile at birth. The basal flora which is comparable to that of adults, is not acquired until some weeks after birth, yet this transformation from the sterile to the bacteria laden respiratory tract does not necessarily usher in disease.

The authors point out that the common cold occurs in a great proportion of infants who live in institutions, though the basal flora of these infants is not changed. Colds which occur in the early autumn are usually mild, and Dochez and his workers assume that the agent which produces these colds prepares the soil for the dissemination of bacteria. In the midwinter the infections are of a severer type, and pathogenic organisms are thought to play a more important part in the colds and other complications. Thus they point out that there seem to be two types of causal agents: the one which initiates and gives rise to a mild disturbance, and the other, one of the group of pathogenic bacteria, which are now enabled to invade the soil prepared by the initiating agent and give rise to severe secondary manifestations.

FILTRABLE VIRUSES

The authors point out that chimpanzees are susceptible to colds when they are inoculated intranasally with bacteria free filtrates of nasal washings obtained from early cases of the common cold. Dochez and his workers also point out that following the animal inoculation of these bacteria free filtrates, certain pathogenic bacteria come to invade the nose and throats of these animals, suggesting that the filtrable viruses prepare a favorable soil in the respiratory tract for the secondary invasion of some of the familiar pathogenic organisms. It is presumptive that the filtrable virus, in the case of common colds, gains access to the upper respiratory tract of human beings and experimental animals, and is capable of producing the milder symptoms of the common cold, which may become more severe, if pathogenic organisms produce secondary infections.

ACID-BASE EQUILIBRIUM

Much has been written recently of the relationship of body chemistry to the upper respiratory diseases. Czerny in his early writings mentions the fact that exceedingly large tonsils and adenoids are observed in children who have been fed milk and eggs excessively and for a long period. He says also that in those infants whom he considers to be suffering from exudative diathesis he recommends an early use of a mixed diet with a decrease in the amount of milk. On the other hand he begins the use of small quantities of meat early. Finally he believes that overfeeding during the first year or two of life tends to produce hypertrophy of the tonsils and the lymphoid tissue of the nasopharynx. Weigert believed that retention of water in the body diminished resistance against infection.

Ludwig Moyer in a recent publication expressed the opinion that the resistance of the nasopharyngeal mucosa against infection may be increased by the use of a rational diet. Food which is low in salt and proteins tends to diminish the water content of the tissues and increases their resistance against infection.

Somewhat along the same line Stolte maintains that infection is more important than exposure to cold in the upper respiratory diseases though he admits that a rapid loss of heat from the body may predispose to catarrhal disease.

He thinks that catarrhal affections of the upper respiratory tract occur most frequently in the spring after bright sunny warm days that the sudden application of sunlight affects the body by increasing the magnesium and potassium content of the blood and decreasing its calcium. As a result of these changes he believes the water content of the tissues is increased thus diminishing resistance and producing a greater susceptibility to upper respiratory infections.

The writings of D. C. Jarvis of Barre Vermont and his associates have attracted widespread attention. Jarvis observed that acid producing food represented the greater part of American dietary. Under this dietary regime he noticed an increase in the redness of the mucous membrane covering the cartilaginous portion of the nasal septum, and often to a lesser degree an increase in redness of the mucous membrane covering the anterior pillars of the fauces and the aryepiglottic folds. On the other hand, in individuals selecting most of their food from alkaline diets, there was an absence of this redness in the locations mentioned above. In the patients with the red nasal septum alkaline dietetic treatment was employed using primarily the citrus fruits. Jarvis also found that excessive sweets in the diet produced redness of the turbinates and subacute laryngitis and that a catarrhal discharge from the nose and throat was observed when there was a lack of the proper amount of vegetables in the diet. A granular condition of the posterior pharyngeal wall was observed when there was an excess of foods made from flour. Finally, the amount of lymphoid tissue was increased when there was insufficient fat in the diet. By correcting the diets in these various patients, marked improvement occurred.

Some control observations were recently made by Bernheimer and Cohen who could not corroborate Jarvis findings. There is some clinical evidence extending over a considerable period of time which indicates there may be a relationship between diet and catarrhal conditions of the upper respiratory tract.

VITAMINS

Recent work seems to indicate that vitamins A and D seem to offer no protection against the occurrence of respiratory diseases. It has also been found that the exposure to ultraviolet rays does not seem to diminish the occurrence of colds in the light treated groups. The investigators at Johns Hopkins University have also pointed out that neither abnormalities of the upper air passages nor hygienic sleep

ing conditions, clothing, exercise, habits, and other commonly assigned causes increase either the susceptibility or the resistance to infection of the upper respiratory tract

ALLERGY IN UPPER RESPIRATORY INFECTIONS

The allergic diseases of the upper respiratory tract frequently seem to have an hereditary background. In a large number of infants and children with allergic manifestations, a family history of anaphylactic reactions is obtained. Sometimes one parent and at other times both are affected.

Longcope has attempted to explain the nature of allergy in some children by saying that it may be caused by the inherited quality of tissue which too readily builds up what may be termed a selective hypersensitiveness. It has also been stated that sensitization may be developed during intercurrent disease possibly due to the absorption of bacterial proteins or to overindulgence in certain foods. Sensitization to eggs may be observed for the first time during an acute illness.

The nature of the allergic diathesis is not understood, despite physicochemical researches. It is not necessary to mention the various vegetable and animal agents, not excluding house dust, which are found to produce allergic reactions. Hay fever, asthma, and allied manifestations may occur in infants and children of every age. One sometimes observes a recurrent bronchitis or asthma associated with eczema during the first year of life. In examination of a given case of hay fever, it is of value to determine whether the vasomotor symptoms are actually excited by the pollen of plants or whether they arise from other causes. Goodale believes that a fairly large proportion of patients who come under his observation show no response to pollens, but the nasal response seems to be excited by the fragrance of the flowers such as lilies of the valley, lilacs, and other flowering plants. Olfactory, vasomotor rhinitis or pseudohay fever may be caused by mechanical, thermal, chemical, and odorific irritants, in addition to the protein substances, both animal and vegetable, already mentioned.

Duke believes that certain of the upper respiratory affections originate through a disorder in the heat regulating mechanism. He believes that many of the non-infectious coryzas, asthmas, as well as dermatoses have their origin during or following the onset of an acute disease. Certain persons may become abnormally sensitive to heat or cold. Duke speaks of thermic coryza, thermic asthma or thermic urticaria or eczema, also of heat sensitive and cold sensitive patients. The nasal symptoms produced are manifested by sneezing, swelling of the mucous membranes of the nose with the increased secretion of clear mucus. The bronchial symptoms are manifested by cough or asthma with the expectoration of clear mucus. Infection and chronic changes in the mucous membranes may be superimposed upon these conditions. Thus, Duke has introduced a new conception into the nosology of upper respiratory infections, which may in some way explain our age old conception of the relationship of cold to these disorders.

It may be emphasized that many of the acute respiratory affections during infancy and early childhood occur during the fall and winter months and seem to depend on various factors. There may be some source of infection in the child's environment and also a particular susceptibility indicating his degree of nonimmunity. In the winter the child comes in more intimate contact with other members of the household or institution in which he lives than during the summer, hence the greater frequency of colds during the winter. The immunity of the child is lower during the winter than during the summer, possibly because he has less opportunity for exposure to the sunshine and, as has been claimed by some, a diminished vitamin content in his food. The young patients are affected in large numbers, especially

If after a period of warm, fine weather there is a sudden fall of temperature with a decline of atmospheric pressure and an increase in the velocity of the wind with a dust laden atmosphere.

COURSE OF THE AFFECTION

In the catarrhal states of the upper respiratory tract one observes marked hyperemia of the mucous membranes with an increase of secretion and round-cell infiltration of the mucous and submucous coats. The infiltration is most marked around the vessels and the dilated excretory ducts of the glands. During the height of the disease there is a marked swollen reddened moist mucous membrane which produces a thin secretion with considerable mucus. Gradually this secretion becomes thick and purulent in character due to the admixture of epithelial cells and leucocytes. This process tends to recede and after a course of two or three weeks the inflammation has subsided and the secretion has disappeared.

At times the acute respiratory affections are preceded by several days of constitutional disturbances such as malaise moderate headache slight elevation of temperature sneezing burning sensation in the throat moderate hoarseness feeling of dryness in the pharynx, and the changes in the mucosa which have already been described. These catarrhal changes may involve the mucous membrane of the upper respiratory tract from the nose to the bronchi. The infectious agent, whatever it is, may spread along the mucous membrane or in the submucous tissue and involve a considerable extent of surface. The nasal involvement is characterized by obstruction and discharge. The face may be puffy the eyes red and secreting and the upper lip swollen. The child breathes with his mouth open and there is a fetor to his breath. The child is restless at night sleeps poorly and snores. In the young infant the temperature may be as high as 104° F and the infant has difficulty in taking the bottle or the breast. At times he becomes dyspneic. The abdomen may become tympanitic or convulsions may occur or the finer bronchi may be involved terminating in bronchopneumonia.

In the older child the condition may become protracted, and during the acute stage he may complain of a headache. In most of these cases an involvement of the nasal accessory sinuses has occurred. Sometimes neuralgia in the region of the supraorbital nerves causes discomfort. Epistaxis, preceded by continuous or violent sneezing has been caused by rupture of a small vessel in the septum. The coryza may cause disturbances in the sense of smell, as well as in the sense of taste which may lead to loss of appetite and refusal of food. An associated inflammation is usually present in the nasopharynx. The eustachian tube becomes swollen, consequently the hearing is diminished or the infection may be carried to the middle ear producing an otitis media. The severity of the disease varies with the age of the patient. Young infants may become alarmingly sick while older children may run the course of a mild local infection.

The retropharyngeal, and the submaxillary lymph glands are frequently swollen or they may suppurate. The catarrhal process may extend to the larynx and trachea and produce dryness with a hoarse voice and dry irritating cough which may be accompanied in older children with some mucopurulent discharge, or the mucosa of the larynx may be red and swollen with extreme dryness. A thick tenacious secretion covers the mucosa of the larynx and produces a spasmodic irritating cough. The same condition may occur in the trachea. In extreme cases the laryngitis may increase with the occurrence of edema leading to stridor barking cough or laryngeal stenosis.

THE ACCESSORY SINUSES

On account of the difficulties in diagnosis, these affections were for a long time disregarded or not recognized. It is known at present that the ethmoidal sinus is

developed during the eighth fetal month and is small, though present, at birth. The maxillary sinuses, while they are developed during the fourth fetal month, are very small at birth. The frontal sinuses are developed from the first to the third year of life and do not become the site of infection until the sixth or seventh year of life. The sphenoidal sinuses develop toward the end of the first year of life and do not become involved until the sixth or seventh year.

If a profuse discharge persists after an acute rhinitis, particularly if the discharge is unilateral, and if one excludes the presence of a foreign body in the nostril, it may be assumed with a considerable degree of certainty that there is an acute involvement of one of the accessory sinuses. In infants this condition is usually confined to one of the ethmoidal sinuses. In infants suffering from ethmoidal involvement, there may be a moderate edema of the eyelid which may be unilateral or bilateral, and in severe cases an abscess of the lid may occur. The simple edema tends to disappear after drainage of the ethmoidal cells. The ordinary lid abscess may be incised and drained, though at times more extensive suppuration may occur producing protrusion of the bulb. In older children other sinuses may be involved. The infection of any one of them may lead to changes in the eye, such as swelling and redness or protrusion of the bulb, retrobulbar abscess, even thrombosis of the orbital vessels. Meningitis by extension is always a possible complication.

Finkelstein and others think most cases of suppuration in the mouth, as well as orbital involvement, are due to infections of the tooth germ. In older children, particularly where there is suppuration within the maxillary sinuses, abscesses may form in the neighborhood.

Osteomyelitis of the upper jaw usually occurs in young infants or young children, is rarely observed in children of school age, and is usually recognized because of the orbital involvement, as both upper and lower lids are edematous. These patients usually have high fever, the affected side of the face is swollen, the bulb may protrude, or it may be displaced to one side or the other and abscesses may form in the mouth, the gums of the upper jaw, with the destruction of the rudimentary teeth.

The sinusitis may become chronic, and after the third year of life, these chronic affections may be the cause of ill health. The submucosa may become fibrosed, and epithelial changes may occur on the mucous surface. The chronic sinusitis may lead to protracted nasal catarrh with mucous discharge. In older children with maxillary sinus infection, irrigation will wash out mucous plugs with slight admixture of pus. This procedure offers one of the most reliable methods of diagnosis. X-ray examination also gives valuable diagnostic information.

RELATION OF SINUS INFECTION TO SYSTEMIC DISEASE

A protracted or obscure fever may be due to an unrecognized sinusitis. Or, the infective secretions escaping from the sinuses may produce irritation or inflammation in the respiratory or even in the digestive tract. Sinusitis may be the focus for the occurrence of general sepsis, and it has also been maintained that either acute or chronic sinusitis may be the focus for the production of rheumatism, endocarditis, asthma and bronchitis, nephritis, and other remote infections.

RETROPHARYNGEAL ABSCESS

The retropharyngeal lymph nodes may become the site of infection and may break down and suppurate, constituting the not infrequent retropharyngeal abscess. It is well known that one must differentiate these abscesses which originate in the lymph nodes of the pharynx from those which arise from caries of the spinal vertebrae. The latter may be recognized by x-ray examination of the spine and the skull bones.

The retropharyngeal abscess which occupies a high position in the pharynx is difficult to recognize at times. Symptoms are often indistinct though nasal stenosis is most common. The children are restless and anxious, on account of the difficulty in breathing sleep is disturbed and the general condition suffers in consequence. Attention is called to this disease by pain on swallowing. The forward projection of the posterior pharyngeal wall is observed early. Perhaps the most reliable method of diagnosis is gentle palpation and the recognition of a fluctuating mass. Retropharyngeal abscess may be dangerous on account of the possible occurrence of a general sepsis and also the gravitation of the pus into the posterior mediastinal space.

GENERAL SEPSIS

What is understood by sepsis? Schottmüller believes that one may term a disease sepsis when a focus has been formed in the body from which either constantly or periodically pathogenic organisms are poured into the circulation and that an account of this invasion subjective and objective disease manifestations are produced. What has been frequently spoken of as pyemia is today called sepsis with metastases. But with sepsis already in progress it is necessary or desirable that its source or origin be located. Blood culture would seem at first hand to be the most reliable diagnostic method though this frequently fails. A sign of great value is the occurrence of a chill. A chill indicates that organisms are being poured into the blood stream, and the patient is suffering the consequences. The difficulty is however that very young infants frequently do not have chills. The diagnosis of sepsis may be easy, or it may present the utmost difficulty. If there is extensive suppuration in the pharynx the way is pointed out. Frequently however, there are no external signs. The tonsillitis may have entirely disappeared and it may be ten days or two weeks before the symptoms of sepsis show themselves. A suppurating process in the pharynx or large painful lymph nodes in the neck are of diagnostic importance. The glands in the neck may lie under the sternocleidomastoid muscle and may escape attention. Pain is frequently present in cases of pharyngeal sepsis.

The internal organs in cases of sepsis should be frequently examined. This is particularly true of the heart, lungs kidneys as well as the joints. Sometimes the first inkling of the correct diagnosis is obtained from the involvement of more remote organs.

POSTANGINAL SEPSIS

Postanginal sepsis has been infrequently reported in early childhood. A review of this condition was published by the author in the JOURNAL OF PEDIATRICS July 1932.

HEMORRHAGE FROM PHARYNGEAL AND PERITONSILLAR ABSCESS

Pharyngitis or tonsillitis, whether occurring as a part of a non-specific upper respiratory infection or one of the contagious diseases, may lead to suppuration in the adjacent tissues and as a result retropharyngeal and peritonsillar abscesses occur. In retropharyngeal abscess the infection is carried by lymphatics to small lymph glands lying anterolateral to the upper cervical vertebra which break down, causing an accumulation of pus, which is circumscribed within the pharyngeal limits but which in some instances may follow the deep fascial planes up to the base of the skull or down to the mediastinum.

Infection of the parapharyngeal spaces is in most instances blood borne through thrombosed veins leading from the tonsil plexus to the tissues external to the middle constrictor and from there may spread to the submaxillary carotid sheath and parotid spaces. The pathways of infection are both lymphatic and venous, as well

as by direct contiguity of tissue, depending on the type of infection. The internal carotid artery lies closer to the pharyngeal wall than the external carotid. The internal carotid artery normally makes several curves in its course in the neck which may become exaggerated into tortuosities that will bring it into close proximity to the pharyngeal mucosa, also it is frequently the site of an aneurysmal dilatation.

Salinger and Pearlman have collected the following figures on pharyngeal hemorrhage. Out of a total of 227 cases of hemorrhage, there were 159 in which no ligation was done and of which only 36 (23 per cent) recovered. Seventy-two cases were ligated, and forty-seven recovered (65 per cent). There were 18 ligations of the external carotid with 11 recoveries (61 per cent), and 54 common carotid ligations with 36 recoveries (67.5 per cent). The vessel most frequently involved was the internal carotid artery. Twenty-five per cent of all common carotid ligations are accompanied by serious cranial complications at least one half of which are fatal. The serious brain complications are due to the sudden shutting off of the arterial supply to half of the brain.

Where successive hemorrhages occur due to the erosion of a large vessel by a retropharyngeal abscess, the presumption is that the source of the bleeding is the internal carotid artery.

PROPHYLAXIS AND TREATMENT OF UPPER RESPIRATORY INFECTIONS

In considering the prevention of the upper respiratory infections, the interest in the subject of "hardening" children has recently been revived, however, it is not a new theme. It has been discussed by the ancients as well as the moderns. Rheum and catarrh were favorite topics discussed by the old Grecian masters. Wadd in his little book *Nursery Mems*—1829, speaks of the fashion then in vogue of hardening children or as he calls it, "Inuring children to hardness." The practice consisted of dipping the child into ice cold water every morning. Needless to say this practice caused the children great suffering and piteous crying. This system of hardening was succeeded by the so called "coddling system." Instead of being plunged into the cold water they were stuffed with food. Thick paps were given in large quantities at frequent intervals, and then flatulence occurred. This was supposed to be due to emptiness, and they were fed still more. Now Godfrey's cordial, now Dalbey's enervative were given to blow away the wind. In the same way calomel was given sometimes in five-grain doses, and repeated frequently, but Wadd, the commentator, says, "all without success." Wadd decried the excessive use of calomel and thought that many were overcalomelized. He calls attention to the serious and somewhat fatal consequences attendant upon the imprudent use of strong medicines. He emphasizes particularly the abuse of antimony and mercury.

J. F. Williams¹ remarks that limitations imposed by the weather cause people to lead unhygienic lives during the winter. For many persons it is a period of semi-hibernation. Elsworth Huntington² says the most stimulating quality of man's environment is a mean temperature between 38° and 64° Fahrenheit. Where it remains above 64° F. all or nearly all the time, or below 38°, human progress is much retarded. Ogle and Mills³ at the University of Cincinnati found that animals adapted to constant heat, lost to a considerable extent their ability to produce heat and keep warm under chilling emergencies. A few hours of cooling each day is shown to overcome the depressing influence of a hot environment.

By hardening is understood the production of an increased resistance against colds by various measures. Young animals and plants are very susceptible to the influence of colds. It may be assumed that infection and exposure to cold are common causes of upper respiratory catarrhs. Just what the relationship of these factors is, is not known. Some one has suggested that the dynamic equilibrium between bacteria and the defense reactions of the body becomes disturbed by chilling,

and infection results from the production of vasomotor disturbances. Ivan Rozen stern maintains that children exposed to fresh air treatment systematically develop a resistance to cold, though he believes that individual constitution is of importance in resisting the affection. His method consists of systematic fresh air treatment combined with exposure to cold or ultraviolet ray.

Children who had been previously susceptible to recurring catarrhs responded favorably to fresh air treatment. He admits that a small number of children have "colds" in spite of the hardening process. He thinks these children have a constitutional susceptibility to infection. Other factors must be taken into consideration besides fresh air treatment, such as nutrition, hygienic care, medication, the proper diet with an adequate supply of vitamins and the acid base balance.

It should be noted that the influence of the same degree of cold and exposure calls forth different reactions in different persons. Marchand considers the predisposition to colds as an individual hypersensitiveness or as a deficient resistance. In other words, a certain abnormal tendency of the body must be present for the development of illness after exposure to cold, though cold cannot be considered the sole causative factor. Predisposition, exposure, and infection seem to be associated in some way whether anomalies of the circulatory apparatus or the much maligned autonomic nervous system are the fundamental factors is also not known. It has been further suggested that the cold may damage or paralyze the cilia of the epithelial cells in the upper respiratory tract. Or as some have thought, the cold may lead to fissures or tears in the surface epithelium of the trachea and lungs.

The child should be clothed so as to be kept comfortably and sensibly warm. He should be protected against local chilling, as well as against cold, wet feet. If his garments become wet or cold by rain or snow or by a fall into a puddle, he should be taken home to have his clothes removed.

If it is found that a child perspires profusely when out of doors or at play he is dressed too warmly. If he is chilly, he needs more clothing. The temperature of the average American home is subject to considerable criticism by foreign visitors. They say that in the winter time the air of the room is too hot and too dry. Of course it must also be added that Americans abroad complain of their inability to keep warm in cold, damp rooms. Whether there are more colds in America or abroad is a riddle which the statisticians have not yet charted.

MEASURES TO PREVENT INFECTION

A few general statements for the prevention of infection may be briefly enumerated. It is known to every practitioner that during the severer seasons of the year, colds and so-called upper respiratory infections occur in epidemic form throughout the community in private homes, and in institutions. When a child, an attendant, or a parent falls ill with a cold he should be isolated from other members of the group and the infant or child should be protected against those who are acutely ill with an upper respiratory infection. Those who have colds and come in contact with the child should wear masks. Respiratory infectious disease is communicated from one person to another by droplet infection, propelled by explosive coughing or sneezing from the sick person. Assemblies of large numbers of persons in schools, theaters, and railroad coaches are distributing points for spreading colds and respiratory infections. The hands should be frequently washed, especially before mealtime, so as to avoid carrying the infection with the food.

Rooms should be cleaned with a vacuum cleaner instead of the old fashioned feather duster. The latter does not remove the dust, but scatters it with its germs through the room. During an epidemic, whether it be in the home or in the hospital, face masks should be worn by persons coming in contact with the sick, as well as those who are convalescing from respiratory infection. Linen, handkerchiefs, and

towels used by those who are suffering from nasal or oily discharges are filthy, unhygienic, and archaic. When replaced in the pocket, they infect the clothes of the carrier and when withdrawn scatter the contagion. Paper handkerchiefs, which should be burned, are preferable. Everything should be done to keep the mucous membranes of the nose, pharynx, and accessory nasal sinuses in a healthy condition. This includes the removal of infected tonsils and adenoids.

THE USE OF "COLD" VACCINES

This form of prophylactic treatment has been extensively employed, vaunted by some, and rejected by others. Since no one definitely knows the specific cause of colds and upper respiratory infection, it is difficult to understand how a specific vaccine can be produced. In this connection we may quote from a recent paper of Dochez and his associates, who summarize the results of vaccine treatment by stating that they believe many of the pathogenic organisms found in the respiratory tract are secondary invaders. They believe the results obtained by treatment of colds with vaccines vary only slightly in the vaccinated and the nonvaccinated groups. They say that if the thesis is correct that the common cold is due to a filtrable virus, no results from vaccine would be expected.

Attempts to immunize infants and children against colds have also been employed. The vaccine was given at weekly intervals over a long period of time, however, Dochez and his workers found there was no reduction in the occurrence of the number of simple colds or of respiratory infection associated with fever in the vaccinated as compared with the nonvaccinated groups. They believe, however, that there may be an apparent reduction in the severity of the infections in the vaccinated infants if a shorter duration of the fever may be accepted as a criterion. Their general belief is that even vigorous vaccination against the organisms identified in these infections offers incomplete protection.

THE TREATMENT OF UPPER RESPIRATORY INFECTIONS

Acute Nasopharyngitis—The child suffering from an acute nasopharyngitis with or without fever, preferably should be put to bed. The room should be ventilated, it should be neither too hot nor too cold. Fresh air is of undoubted value. The windows should be open for a time at least each day. Under properly conducted fresh air treatment the child becomes quieter, the appearance improves, circulation stabilizes, the respiration becomes more quiet, and he is less restless, and sleep is induced.

The question of the treatment of the nasal discharge and the swollen nasal mucosa varies in the opinion of the practitioners. The use of the silver solutions, such as argyrol, sylvol, and protargol, is widespread. Nearly every mother and nurse has a bottle on the shelf. It is certain that the uncontrolled and continued use of these preparations has caused argyria in some instances. In addition, these preparations may be irritating to the nostrils and are of doubtful value. The menthol, eucalyptol, thymol, camphor preparations, whether as an oil or ointment, may give temporary relief. However, in the end they may be irritating while the relief is only subjective. There is always the danger of forcing secretions into the eustachian tube if the oily preparations are used with considerable force. Recently we have been cautioned against the possibility of aspiration pneumonias from the instillation or the aspiration of oil into the bronchi. The preparations of ephedrin and adrenalin in solution or in ointment, or the instillation of normal salt solution, or horse and cod liver oil solution, frequently give relief. The doctors of a generation ago used mild sugar solution, a practice which has been revived in some quarters.

When the patient is in bed, he should be kept on a bland nonirritating diet with a measured amount of milk, a low protein and a moderate carbohydrate diet. The

citrus fruits, and other stewed fruits honey, jellies and syrup on bread, in moderation, and water in abundance. The room should be kept moist. This is best done by soaking large Turkish towels in warm water and hanging them on a line, or large clothes horse and sprinkling small quantities of oil of eucalyptus or turpentine on the wet towels. This method supplies a pleasant moisture to the room and in my opinion is far superior to the boiling steam kettle, which makes the room hot and stuffy most often uncomfortable. These acute upper respiratory infections are frequently self limited and over treatment is not required or desirable. On the other hand, complications, which have already been referred to and which may require special attention, may occur.

TREATMENT OF SINUS INFECTIONS

The use of hypotonic salt solution to free the nostrils and the nasal mucosa of discharge will in some instances reduce the swelling of the nasal mucous membranes and promote drainage from the sinuses. The value of irrigation or suction of the sinuses in the acute or hyperacute stages is doubtful, indeed, these procedures may do harm in this stage. Where the sinus infection goes on to protracted stage, surgical drainage of the affected sinuses will become necessary. Quartz lamp treatment during the winter or a change to a warm, dry climate may be recommended. Vaccines are recommended by some and disapproved by others. On this point the final word has not been spoken although one cannot help saying out loud, 'If you do not know the specific organism, how can you prepare a specific remedy?' Or perhaps by some hit or miss method we are using some vaccine which may contain an unknown specific antigen.

As for the treatment of the associated lymphadenitis, nothing now can be recommended. The ice-bag externally—in the later stages several mild x ray treatments given about a week apart cause the glands to diminish in size and eventually to disappear.

Tracheitis is treated by inhalations, warm drinks, and sedatives for the irritating and disturbing cough.

If the upper respiratory affection is due to an allergic condition its cause and nature should be ascertained either by the elimination method or by skin tests and an appropriate regime and management either dietetic or by removal of the offending allergen.

I shall not enter into a discussion of the treatment of the remaining disorders of the upper respiratory tract as, except in the case of diphtheria, there is no specific treatment. In considering laryngitis and bronchitis, the treatment is in the first instance, prophylactic, finally expectant and symptomatic and while there is considerable individual variation as to the methods employed all are agreed that these affections in the vast majority of the cases, are self limited and that a rational therapy without overdoing careful management without neglecting the cardinal symptoms of hygiene and common sense, will in the majority of cases offer the most efficacious plan of treatment. And it is also true that infection of the ear and mastoid, abscess formation in the pharynx, hemorrhage due to ulceration into a large vessel, as well as infection of the accessory nasal sinuses will frequently require the aid of the surgeon or the otolaryngologist.

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DR F S CLARKE (OMAHA, NEB) — You intended, it seemed to me, to show that in most of your cases of upper respiratory infections the child was not healthy. In my opinion, at least 50 per cent are healthy children.

DR CASPARIS — I did not mean to give that impression. I wanted to say that the healthy children are not as badly attacked by these infections since the healthy child recovers from them in better condition.

DR RALPH M TYSON (PHILADELPHIA) — You spoke about the diet in building up the general health. Do you believe an excess of carbohydrate food, which is the cheapest food, has anything to do with making the mucous membrane more susceptible?

DR CASPARIS — These children who are fed an excess of carbohydrate give the impression that they seem to be more susceptible and do not do as well if they get an infection.

DR TYSON — I wondered whether it was the excess of carbohydrate or imbalance of the diet which gave this impression.

DR CASPARIS — I do not know.

DR ELMER L TIMMONS (COLORADO SPRINGS, COLO) — You do believe that where there is an enlarged tonsil and a severe infection, a child may go on without the tonsil being removed?

DR CASPARIS — I think there is more to a bad tonsil than its being large. A history of attacks of tonsillitis is important. I would be inclined to let a healthy child go on who is getting along nicely, even though the tonsils are enlarged, and there is nothing else much except the enlarged tonsil. We have followed some of these patients for six months, trying to decide whether the tonsils were causing the trouble. They were undernourished and had a poor appetite. When the tonsils had been removed, they would gain five or ten pounds in the next month or so, and we have the impression after such experiences that that type of tonsil was a handicap. I use everything at my disposal to decide whether the tonsils are handicapping the child. I believe tonsils are very beneficial but just as soon as they get to be a handicap, then is the time to remove them. Being able to decide that is not always easy.

DR TIMMONS — I have had the same experience but when these children fall into the hands of an enthusiastic throat surgeon, they are persuaded to have them removed. I can recall about six cases of this type. The tonsils were not handicapping the child. I have seen these children recently and they have not been hurt by the tonsils.

DR ARTHUR ABT (CHICAGO) — Do you think hypertrophy of the tonsils can cause deformity of the mouth and jaw?

DR CASPARIS — I think deformity is more apt to be caused by the child's poor general nutritional state. Rachitic children with weak muscles and bones that are not developed are more apt to have trouble. I suppose some deformity might develop from hypertrophy especially when the adenoids are actually blocking the nasal passage. This brings up the question of thumb sucking. I have seen so many children who have sucked their thumbs for three or four years with perfectly good mouths that I think there is more to it than partial obstruction.

DR TYSON — Are the endocrine glands active in developing immunity?

DR CASPARIS — I would like to have your opinion on that.

DR TYSON — It seems to me that children develop an immunity against colds at about the age of six. From the age of six to nine years, they are not subject to colds any more. I have wondered whether the sex glands are more active and stimu-

late a general and natural immunity or whether the repeated attacks of infection produce a specific immunity

DR. CALVIN E. BRADLEY (TULSA, OKLA.)—One etiologic factor overlooked by the average pediatrician is the bed and sleeping room of the child. I think these patients develop immunity to colds because they grow older and are transferred to a larger bed. The crib of an average child will have a mattress like a comforter and over it will be piled blankets and covers. Parents forget that cold air comes up underneath the child and his resistance is lowered.

When the child is put to bed, the windows are opened allowing the breeze to come in, and there is a tendency for the child to chill especially when he is quite inactive. It will undoubtedly produce irritation of the mucous membrane of the respiratory tract.

The humidity of the room also is not constant. Sometimes the room will be overheated, and the air becomes very dry. The mucous membrane does not secrete an amount of mucus sufficient to protect against invasion of organisms. There is a source of constant contamination from other members of the family who have chronic sinusitis and cough in the face of the patient.

DR. CASPARIS—Humidity is a factor that has a great deal to do with the vulnerability of the mucous membrane of the upper respiratory tract. The mucous membrane is protected by the secretion of mucus. I think people will have more tendency toward infections if they live in houses where there is overheating and drying of the air.

Most people do not realize that infants and small children do not need as much cover at night as the adult because they maintain their body heat much better. The average child does get out from under his covers, but he is often wet with perspiration when he does and gets a chill. If the average child uses half the amount the adult does, this may have something to do with protecting him from getting a chill if he crawls out from under his covers.

Swimming in pools is another important factor, as most of the water in these pools is chlorinated. Persistent infections occur in children who swim a great deal. Some nose and throat men say that the human body is not built for water and that we should never swim. That is pretty hard. Yet, there is no doubt that these children are taking a chance of getting severe infection from the water carrying organisms into the sinuses.

DR. NICHOLSON (PHILADELPHIA)—How often do you x ray children with these recurring colds?

DR. CASPARIS—X ray examinations have to be very good to get much information other than a very marked sinusitis. In the usual x ray in which we cannot see the soft tissues, we cannot tell much about the findings. You can tell also by the nasal discharge and whether or not the child seems to be retarded by the infection. There is always some sinus infection in these recurring colds and if they persist and the child does not improve, involvement of the sinuses must be suspected.

DR. JULES M. BRADY (St. Louis)—Dr. Casparis mentioned vitamin A but nothing has been said about vitamin D. I recall the day when upper respiratory infections were a regular plague and many babies died of bronchopneumonia. Some four or five years ago we routinely used ultraviolet rays on all our babies every other day and since that time upper respiratory infections have occurred of course, but they seem to be milder. Bronchopneumonia is rare, and I feel this should be emphasized. We gave cod liver oil for years and the babies continued to have rickets. Now we have abandoned cod liver oil and do not use viosterol. We depend entirely on proper diet and the regular use of ultraviolet rays. We believe this has an effect on reducing the mortality.

DR. CASPARIS—I would like to emphasize the fact that every one with an upper respiratory infection should stay away from infants.

With regard to vitamin D, I cannot say much. When we had a lot of rickets, the babies were susceptible to bronchopneumonia. It was felt that this was due to lack of cod liver oil and vitamin A. Vitamin D from irradiation may have something to do with it. The men in Baltimore were not particularly impressed by irradiation but their work was in older children.

DR. BRADY—Our babies get plenty of vitamin A.

DR. CASPARIS—It is very interesting, and this method of feeding may have something to do with it. We have learned a great deal in the last five years in regard to infant feeding and the effects of vitamins A and D.

DR. NICHOLSON—Are there any other factors in ultraviolet rays?

DR. CASPARIS—There may be some very important factor present in ultraviolet rays.

DR. NICHOLSON—I have found that my babies who do not gain on ergosterol do gain under ultraviolet rays.

DR. FRANK T. MITCHELL (MEMPHIS, TENN.)—For the past fifteen years I have been most interested in the type of sinus infection which should be drained. We have tried to determine the development of the sinus and have observed some 200 normal infants during the first ten days of life to see what sinuses were present. We have found that the maxillary sinuses are present at birth, some being larger than others. Our work shows that the shape of the sinus will resemble somewhat that of the parent the child resembles most in general facial expression, also the sinus history will follow somewhat the sinus history of that parent. I might mention an instance of a family where the father was a typical sinus sufferer with very poorly developed sinuses. The mother had normal sinuses and no sinus trouble. A daughter resembled the mother and had normal sinuses while three other children who resembled the father in facial expression, resembled the father also in their sinus history.

The sphenoid sinuses do not develop much before the fourth year and continue until the child is about ten years old, at which time the development of the sinus is complete. The ethmoid sinus is present at birth and develops until the child is twenty-five years old. The frontal sinus begins to develop about the eighteenth month and continues to develop until some time about the fourth year. I think it is fairly well accepted now that the frontal sinus develops as a result of a migration of cells from the ethmoid to the frontal bone.

We believe if one suffers from a sinus infection early in life, the frontal sinus does not develop. This is coincident with development of the maxillary sinus. If sinusitis is continuously present for some time, there is a retardation in development so that you can tell a chronic sufferer by the development of these two sinuses particularly. We have taken many pictures of adults who have shown no sinus development at all and in whom the frontal sinuses are entirely absent and the maxillary sinuses are halfway down the nose. This is an infantile type of sinus.

In deciding whether a sinus should or should not be drained, we have depended the last few years on the anatomy of that sinus. The sinus is lined with columnar ciliated epithelial cells implanted in the mucous membrane. This works all secretion toward the opening into the nose. If a child suffers from sinus infection, scar tissue will close the opening which discharged the secretions, consequently, something must be done to reestablish this drainage. We recommend a simple drainage through an necessary opening under the turbinate into the nose and injection of a brain broth. That should be the only surgery attempted in the necessary opening of a sinus. We leave in a tube for about four days so that the drainage will continue. We touch only chronic sinuses, we do not ever touch an acute sinus.

If a child eight years of age with infantile sinuses and attacks of sinusitis is sent to Florida, while on the beach he seems to have sufficient drainage so that his symptoms disappear, but when he returns to Memphis the sinuses fill up, and he

again does not have sufficient drainage. Do these children who have sinusitis with infantile sinuses suffer for the rest of their lives or can you re-establish the development which should have taken place? Our experiences have consisted so far in following these cases with a control in this way. We have compared a group of children, eight or nine years of age, with no frontal sinus and a poor development of the maxillary. In some instances, we have operated on those children to drain the sinus and watched the individual child two or three years. At the age of sixteen or eighteen, we have found a normal sinus development. The frontal sinus would be normal, and the child would no longer be a sinus sufferer. In other instances where operation was refused, the children retained their infantile sinuses and had trouble during this period. We believe that if this opening in the maxillary is closed, the children will show the topography of chronic sinusitis. We believe surgical intervention is necessary to re-establish drainage, or these children will suffer year after year.

One other point I would like to mention and hear discussed is. Does the removal of healthy tonsils predispose to sinus infection? Some of the laryngologists say it does not, others disagree. One says definitely that when you remove normal lymphoid tissue which has some purpose, an extra burden is thrown on the remaining lymphoid tissue. I do not see why the tonsil was put there if it is to be immediately removed without any cause.

DR. JAMES G. KRAMER (AKRON, OHIO)—I wonder if you would discuss the different medical procedures?

DR. MITCHELL.—In acute sinusitis, I agree with Dr. Abt, there is no particular treatment other than building up the child generally, supplying the proper food and vitamins. It has been claimed that a red sinus means too much acid in the system, the pale sinus too much alkali. The diet should be regulated along those lines.

In chronic sinusitis, it has been my experience that nothing permanent is accomplished without drainage. I think thorough surgical drainage is the best and is necessary. An accessory opening should be made under the turbinate so that the natural opening will not close.

One other point I should like to make is that we have found the tonsils will continue growing in some cases until about the eighth year, then for some reason they retrogress and a great many children who have had tonsillitis until that time if they are let alone, seem to do very well. We have also observed that some children whose tonsils were removed show improvement, but the next year the same symptoms reappear as were seen before the tonsils were removed.

DR. TYSON—What about the use of transillumination in making a diagnosis of sinusitis?

DR. MITCHELL.—We believe transillumination is of no use. We depend on the x-ray almost entirely in the diagnosis of chronic sinusitis. This means not upon the shadow but upon the topography of the sinus.

DR. TYSON—Do you think the improper development of the face depends on adenoid enlargement, or is due to changes in the nose?

DR. MITCHELL.—Changes in the nose.

DR. TYSON—Is the obstruction due more to a nasal condition than to adenoids?

DR. MITCHELL.—I will answer that by saying if the adenoids are removed one winter, the following winter adenoid symptoms will return, and you will find there is also a marked sinusitis.

DR. BRADLEY.—Have you found that patients in whom an adenoidectomy and tonsillectomy have been performed, a chronic postnasal drip develops later?

DR. MITCHELL.—Yes, but we do not know what would have happened if these operations had not been performed. We often see no relief following these operations. We remove adenoids only when they are hypertrophied.

DR FREDERICK C RODDA (MINNEAPOLIS, MINN.)—It is fair to assume that our experiences up nearer the north border, where we have both low and high temperatures and the air is very dry, might be different. Undoubtedly, damage is done to the mucous membranes of some of our children. I feel that the production of a certain humidity is a great help but that depends upon how you use it, for the child is in school most of the day, and although there may be the right humidity in the home in the day, it is not present at night. Some form of air conditioning better than the present form will cut down the incidence of upper respiratory infections.

We have also noticed that when sunny days come in March and April when we should expect betterment in the condition of these patients, there is a most vicious type of infection. This may not be so common but the infection is vicious, and it is hard to determine whether the child gets an overdose of sunshine in the first days of spring.

In comparison with conditions fifteen years ago, I think there are two factors which are important, we have better technique and we are more hygienic. We must not overlook the peculiar cycles of infections. If we are going to draw conclusions, we must include a larger cycle than a period of a few years.

DR ORVILLE E BARBOUR (PEORIA, ILL.)—In speaking of this late spring infection, I think the element of fatigue plays an important role. We all see examples of a lowered resistance and the appearance of infection in late spring. We see a great deal of this toward the end of the school year. I have always felt that the element of fatigue, both mental and physical, entered into the condition. Perhaps, as Dr Rodda mentioned, the sudden sunshine might be the cause. Stimulation from the sun might be injurious rather than helpful.

DR ISAAC A. ABT—I expect that the element of fatigue does have something to do with these late spring infections. It is so difficult to evaluate these different facts as one is so likely to minimize one and overvalue another. Anything that decreases bodily strength I presume decreases bodily resistance.

DR CHARLES N KENNON (MIAMI, FLA.)—We have as many respiratory infections in Miami as in other climates farther north, the climatic advantages there are less certain than it would appear. Many a child comes from Chicago for the winter sun and may have as many colds, though possibly less virulent, as he may have in the North and that same type of cold often recurs on his return home. Many children who have been quite uncomfortable with sinusitis go to Miami or the lower coast of Florida and are relieved, but after returning to their homes they have recurrences. We feel that the number of colds is practically the same in Miami as it is in the North.

DR ISAAC ABT—Do these patients get too much sun perhaps?

DR KENNON—The fact that the native born also have colds makes me feel that something other than the element of sunlight or calcium base metabolism is the important factor. It is an interesting thing that some of the children who are out of doors and get too much ultraviolet rays in the winter complain of headache and marked fatigue. If they put on dark glasses or stay out of the sun, they adjust themselves. This discomfort is accompanied by definite edema of the nasopharynx.

DR TYSON—We are all familiar with the experience of going from one city to another and contracting a cold. I am wondering whether this transfer from the North to the South or vice versa is not a question of immunity to a certain type of organism. This immunity is lost for a while, and it is like a new group of organisms, and it is necessary to regain that immunity.

DR BARBOUR—Perhaps diet might be a factor. The vitamin and mineral content of the food in Florida is different.

DR NICHOLSON—I have used bacteriophage with good results in 100 cases. In none of these cases has there been any operation and successive x-ray pictures

show the sinuses largely elevated up. In some of the cases there were large retentions of pus in the ethmoid sinuses, consequently, I am inclined to believe that if we could reach them in the early stages before they become chronic, we would get better results.

DR. CASPARIS.—Bacteriophage has been used in various types of infection and good results have been reported. We used it in an epidemic of very severe infection, and it did not accomplish anything. Others have used it in mild infections and have had wonderful results. It has been used in dysentery but its use in this condition is difficult to evaluate because we have epidemics of mild and severe infection. With regard to its use in other conditions, the results are varied.

DR. NICHOLSON—I think the ordinary commercial bacteriophage is useless. The bacteriophage we used was made by a pupil of d'Herelle and the results with this type of bacteriophage were excellent. This is very important in testing the value of bacteriophage.

DR. CASPARIS.—I wonder if there is any disadvantage to lowering the temperature in these infections. It has been suggested that one of nature's methods of destroying the organism is to elevate the temperature. Then we come along and lower it. Theoretically, it places the patient at a disadvantage.

DR. TYSON—We must remember that the temperature affects children differently.

DR. CASPARIS—I do not mean to make the patient uncomfortable, but may we not give drugs that give relief without lowering the temperature? Theoretically, if it is nature's means of combating infection we are putting the child at a disadvantage by taking it away from him.

DR. ISAAC ABT—It seems to me that temperature has its dangers. There is not much to worry about in a man or child who has a moderate temperature but we know very well if the temperature ascends there are certain heights that are not compatible with life. Also, the child who has a high temperature loses his appetite, will not drink, is very restless, and one of the good things you do by reducing the temperature is to increase the fluid intake and this makes him more comfortable. He sleeps and is not restless. Some good is done, his distress is relieved, and I do not believe you are doing any harm. In the newborn premature our great effort is to maintain his temperature. We go so far as to keep the temperature between 80 and 90 degrees. On the other hand, when the temperature is extremely high, we try to lower it or bring him in a cooler environment so that after all the normal temperature is the temperature at which we live best and thrive best and even in disease it seems to me if you can reduce the temperature moderately we are not interfering with the vital processes. Of course, I am answering this without any thought of the scientific value but of the practical values.

DR. BRADLEY—What do you consider the best antipyretic? The patients in whom I have used the one you suggested have had nausea, vomiting, and discomfort.

DR. ISAAC ABT—I think it depends entirely on the patient. Any antipyretic that will do no harm and is borne by the patient is the one to use. I do not think there is any one better than another.

DR. CASPARIS—Do you consider it unfavorable to see a patient with pneumonia who does not have much temperature response? In other words, is a high fever with pneumonia favorable or not?

DR. BODDA—I would think a moderate temperature with pneumonia would offer a better prognosis than extreme hyperpyrexia.

DR. ISAAC ABT—From my own experience I have seen pneumonia patients with a temperature of 104° F and over. These were not the lobar types and would go on to recovery. On the other hand, I have seen little babies with terrifically high

temperatures that continue as terminal temperatures, and the patient died. The summer of 1890 we had a lot of cases of sunstroke. I do not know whether any of you deal with this condition, but these men would fall off their wagons, and the children fell in their play and every hospital in this whole region was treating emergency sunstroke cases. These patients would be brought in in patrol wagons and delivery wagons. We were in the midst of a terrific heat spell. These patients would have temperatures from 109° to 112° F. Those we could get to rapidly and reduce their temperature we could save, but those who were neglected or were a long time coming to the hospital, just burned up, dried up and died. We saved a certain number of them, and it seemed to me that those who were saved were those who were brought in quickly and their temperature lowered by artificial means. It shows what extreme temperature does. What the pathology of sunstroke is, I do not know but at any rate, there is a complete loss of control of heat regulation. As far as pneumonia is concerned, I have seen children with a high temperature, who ran a favorable course.

DR KRAMER—I have been using a certain technic in tonsil work which I think is valuable and extremely important. The tonsil is imbedded between the two pillars which are made up of musculature. Normally the tonsil is emptied continually by massage of these muscles, expressing the material out of the crypts. Press the tongue down with a tongue blade and another blade is applied to the pillar laterally. With definite pressure on the anterior pillar, press out infected material, and if you can evacuate the crypts of that material, I should say you have a tonsil that needs to come out.

DR ISAAC ABT—But you have other indications.

DR KRAMER—I am just adding that to all the other indications.

Academy News

The fourth annual meeting of the American Academy of Pediatrics will be held in Cleveland on June 11 and 12, 1934. The program will consist of various round table discussions to be given on Monday, June 11 at 9 A.M., and will be repeated for a second group Tuesday afternoon, June 12 at 2 P.M. These round table discussions will be held at the Wade Park Manor Hotel, the headquarters of the meeting.

General meetings of the Academy will be held on Monday afternoon and Tuesday morning in the Cleveland Medical Library. On Monday morning, Professor Wallgren of Göteborg, Sweden, will address the Academy, and there will be a business meeting. Tuesday morning there will be panel discussions on "Dental Caries" by Dr. F. F. Tisdall and "The Ductless Glands" by Dr. R. G. Hoskins.

The meeting of the Academy will precede the meeting of the American Medical Association.

Hotel reservations should be made directly with the Wade Park Manor Hotel.

The following committee has been appointed to take charge of the program for the annual clinical meeting of Region III of the Academy to be held at Rochester, Minnesota, on October 4 and Minneapolis on October 5 and 6, 1934.

Chairman Dr. Henry F. Helmholtz.

For Rochester Drs. Amberg and Kennedy.

For Minneapolis Drs. Huencens, Rodda, Stewart and McQuarrie.

Dr. Harold H. Mitchell, 270 Rose Street, Freeport, New York, has been appointed secretary of the Committee on School Health and School Health Education.

Comments

THE Fourth Annual Meeting of the Academy will be held at the Wade Park Manor Hotel in Cleveland June 11 and 12. The Executive Committee has made several changes which should add to the interest of the meeting. Eight round table discussions will be held in duplicate on Monday morning and Tuesday afternoon. This will give each member the opportunity to attend two discussions. On Tuesday afternoon two panel discussions have been placed on the program. At the general meeting on Monday afternoon the committee reports will be mimeographed so that only important matters and recommendations need be discussed. In addition to the President's address, there will be an address by Dr. Wallgren of Göteborg, Sweden, who is the guest speaker of the pediatric groups this year. The commercial exhibit tried out for the first time at Chicago last year was so successful from both the exhibitors' and Academy's viewpoint that it will be repeated. In addition some scientific and educational exhibits are planned.

It is hoped the attendance this year will be large. Cleveland is easily accessible to a large part of the Academy membership. Reduced railroad rates may be obtained by registering with convention travel certificates at the A. M. A. meeting. The meetings of the Section on Pediatrics of the A. M. A. will be held on Wednesday, Thursday and Friday mornings. The two meetings together offer not only an unusual opportunity to listen to and take part in a wide range of pediatric discussions but the opportunity to greet old friends and make new ones in the field in which we are working. Perhaps after all this is the most important thing to be gained in medical meetings of national societies.

THE following excerpts are taken from an editorial in the *Journal of the American Medical Association* March 31, 1934, entitled "Certification of Specialists."

"At the last annual session of the American Medical Association a resolution was adopted authorizing the Council on Medical Education and Hospitals to express its approval of such special examining boards as conform to standards of administration formulated by the Council and urging the Board of Trustees to use the machinery of the American Medical Association including the publication of the Directory in furthering the work of such examining boards as may be accredited by the Council. Pursuant to that action the Council is beginning with its task of designating and classifying the specialists of the United States. Arrangements have been made in the publication of the next edition of the American Medical Directory to indicate those physicians who hold the certificates of some of the boards already established, and also to describe the nature of the boards which will be considered acceptable by the Council.

"In the meantime as a result no doubt of suggestions made at a hearing before the reference committee of the House of Delegates at the meeting in Milwaukee, the certifying boards already established have organized among themselves an advisory board which it is presumed, will serve to coordinate the activities of the several boards, standardizing their methods of work and advising with them in their operation. The functions of this coordinating board are clearly to aid in the practical operation of the boards rather than to define their methods of work or to sit in judgment on the results of their operations.

"The machinery of the American Medical Association in support of the work of the certifying boards has already begun to function to some extent. The mere description of the boards in the American Medical Directory and the listing of those who hold the certificates is in itself a vital step in making effective the advancement of the specialties concerned. Beyond this, however, the American Medical Association has broadcast over the radio, through newspapers and to some extent through its periodical, *Hygeia*, a description of the certifying boards and a statement as to the significance of their certificates. As information concerning the work of these boards becomes more widely disseminated among both the medical profession and the public, their prestige must grow. Eventually the young man who wishes to make for himself a place in any of these specialties will consider the securing of a certificate by a council recognized certifying board as the first step in such a procedure. Hospitals will also do well to be guided in their staff appointments by similar qualifications.

"Movements of this type necessarily develop and advance slowly. However, with the qualifications and restrictions that have been outlined, there is reason to believe that the certifying boards will do much to advance the quality of specialistic service available to the people and to the profession of our country."

Erratum

In Dr. Lewis Webb Hill's article, "Erythroderma Desquamativa," in the April, 1934, issue of the Journal, p. 440, the sentence beginning on line 4 should read

"Four were cured in from four to six weeks, one is at the present greatly improved, and one is not at all improved after two months of this feeding."

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'As to the kind of extra carbohydrate to be added whether lactose or maltose I believe dextri-maltose to be better in general in cases of fat indigestion (infantile atrophy). —C H Dunn *The Hygiene and Medical Treatment of Children* Southworth (a Troy New York), 1917 1 1 p 418

In discussing the treatment of (decomposition) Feer says 'The period of repair may be shortened by giving suitable additional food the best probably being buttermilk to which carefully regulated proportions of dextrin and maltose preparations or malt soup are added. —E Feer *Text-Book of Pediatrics* J B Lippincott Co, Phila, 1922, p 284

In the treatment of (infantile atrophy) Fischer recommends the following 'The carbohydrate should be increased by gradual addition of dextri maltose

'Malt soup or dextri-maltose (Meads) should be added in teaspoonful or more doses to each feeding until the point of carbohydrate tolerance is reached. —L Fischer *Diseases of Infancy and Childhood* F A Davis Co Phila 1925 1 1, p 285

Grulee discussing treatment of (decomposition) observes 'As a rule it is best to start with 2 to 2½ or 3 ounces of albumina milk to the pound weight in 24 hours the sugar to be added is in the form of a maltose-dextrin mixture One should never delay too long in adding this. —C G Grulee *Infant Feeding* W B Saunders Co, Phila, 1922, p 265

Referring to the (hypotrophic infant) Herrman writes 'In mild cases the addition of dextri-maltose instead of cane or milk sugar may be sufficient to obtain a gain in weight. —C Herrman *The treatment of nutritional disorders in artificially fed infants*, New York M J 114 155-160 August 1921

In discussing artificial feeding in (athrepsia) Hess states 'The carbohydrates are usually added in a slowly fermentable form such as the maltose and dextrin compounds which are usually started by the addition of four grams per kilogram (1/15 ounce per pound) and increased until eight grams or more per kilogram (¼ ounce per pound) of body weight are added. —J H Hess *Feeding and the Nutritional Disorders in Infancy and Childhood*, F A Davis Co Phila 1928, p 278

Concerning the treatment of (marasmus) Hill says 'When the stools have become smooth and saive-like carbohydrate, in the form of dextri-maltose may be gradually added up to the limit of tolerance. —L H Hill *Practical Infant Feeding* W B Saunders Co Phila 1922 p 281

A (spasmodic baby) on bottle feeding should receive a limited amount of milk—a pint or at the most 24 ounces in the 24 hours—to which cereal gruel and some form of sugar is added preferably one of the malt dextrin preparations also the early addition of other foods than milk to the baby's

diet. —M Jampols *Infantile spasmodia* *Interstate M J* 25 652 Sept 1918, *abst Arch Pediat* 35 691 Nov 1918

With reference to the treatment of (diarrhea) Lust writes 'After several days 2% to 3% of a maltose dextrin preparation may be added (Dextri Maltose) This is preferable to the easily fermentable lactose or cane sugar. —F Lust *The Treatment of Children's Diseases*, J P Lippincott Co, Phila 1930 p 145

'The treatment of artificially fed children in the first of these groups consists in putting them on a low fat dietary and giving them carbohydrate in the form of one of the less fermentable sugars—e.g. dextri-maltose. —L G Pearson *Feeding disorders of early infancy*, *Lancet*, 1 687-694 April 5 1924

Pearson and Wyllie in discussing the treatment of milder cases of (marasmus) say 'Regulation of this disturbed organismal balance is obtained by the addition of carbohydrates, while fat and casein are reduced For this purpose dextri-maltose and flour are better than the ordinary sugars, since they are more slowly absorbed and have greater efficiency in their powers of controlling the flora in the large intestine. —H J Pearson and H G Wyllie *Recent Advances in Diseases of Children*, P Blakiston's Son & Co Phila 1930 p 116

Regarding the treatment of the (marantic infant) Raue states 'After the intolerance to sugar has been overcome a carbohydrate preferably Dextri maltose may be added. —C S Raue *Diseases of Children* Boericke & Tafel Phila 1922 p 427

In discussing the treatment of (atrophy) Thurstfield and Paterson state 'If the baby continues to improve, the next step in the treatment is to add to the milk one of the less fermentable carbohydrates such as dextri-maltose. —H Thurstfield and D Paterson *Diseases of Children* William Wood & Co, 1929, p 105

'I also find dextrin maltose an excellent addition to albumin milk when the first object of that food has been achieved and a gain in (weight is desired) in this way I have succeeded in feeding albumin milk far beyond the period usually advised with highly gratifying results. —F J Wachenheim *Infant Feeding, Its Principles and Practice*, Lea & Febiger Phila 1915 p 158

'Dextri maltose has been substituted for lactose not infrequently when the tolerance for the latter continues low. —J H West *Low fat, high starch evaporated milk feeding for the (marasmic baby)*, *Arch Pediat* 48 189 193, March, 1931

'Malt sugar is indicated when others fail to produce a sufficient gain or when (malassimilation of Int) is evident. —O H Wilson *The rational carbohydrate in infant feeding*, *Southern M J* 11 177 March, 1918 *abst Arch Pediat* 35 147 July 1918

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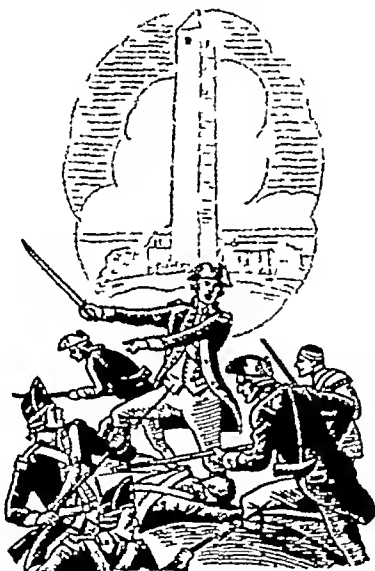
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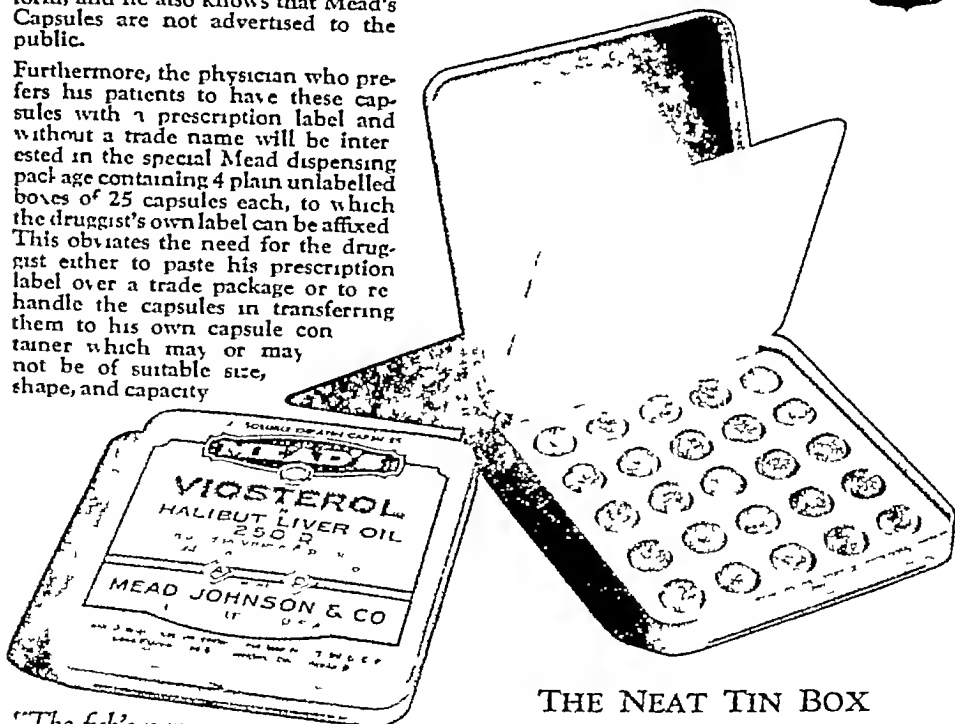
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Grape sugar In one-month baby 8.0 grams per kilogram (Greenfield)

"Galactose No accurate data.

"Levulose (Lower for babies than adults.) One gram per kilogram (Keller)

Maltose: Over 7.7 grams per kilogram (Remes)

Lactose: 3.1-3.6 grams per kilogram (Gronz)

Cane sugar: Probably about the same as lactose (Remes) —J. L. Morse and F. H. Talbot, *Physiology and pathology of the digestion of the carbohydrates in infancy* Boston 31 & S. J., 194:882-883 June 15 1911

1912

"Maltose has for many years been considered one of the most valuable of infant foods in modifying milk for muls, but the German school in the last few years has called special attention to the value of this sugar as a substitute for milk and cane sugars in conditions of intestinal fermentation. It is more easily assimilated and more rapidly absorbed than lactose or saccharose and it may be taken therefore by the infant in larger quantities without producing sugar fermentation."

"Maltose is especially indicated in the feeding of very young and delicate infants, and in all cases where either milk or cane sugar has produced intestinal fermentation and sugar intoxication. In the feeding of maltose it has been found advisable to combine it with about equal parts of dextrin. In Germany and later in this country, Schaefer's Nahrungsmittel (which contains maltose 62.41 per cent., dextrin 41.26 per cent., and sodium chloride 5 per cent.) has been largely used. Mead's Dextrin Maltose (malt sugar) which contains about equal parts of dextrin and maltose, is a similar preparation which may be used instead of milk sugar or cane sugar for modifying milk mixtures." —B. K. Rachford, *Diseases of Children*, D. Appleton & Co., New York 1912 p. 185

1913

It is well to start with one ounce (albumin milk, or albumin-buttermilk) to every pound of body weight in the twenty-four hours, increasing gradually until two or three ounces to the pound of body-weight are being given. Then add sugar preferably a malt sugar about one-fourth of an ounce at a time to the twenty-four-hour quantity until an ounce or an ounce and a half is being given. —J. Foods, *Principles of treatment in malnutrition and atrophy of infants* Interstate M. J., 20:1913 No. 8

1914

Milk sugar and cane sugar may be used in infant feeding but my preference is for malt sugar. Mead and Johnson put up a convenient preparation which they call Dextrin-Maltose and which consists of maltose 51 per cent., dextrin 47 per cent., sodium chloride 2 per cent., and which has a food value of about 110 calories per ounce. —J. A. Gerson, *Widespread milk dilutions in feeding normal infants* Washington Med. Annals 13:58-59 Jan. 1914

1914

Dextrin maltose causes the greatest gain in weight, cane sugar less and lactose produces the least gain. —H. S. Reichen, *Observations on milk station infants* Arch. Pediat., 31:176-196 March 1914.

1914

"A composite opinion of the sugars is in favor of dextrin maltose, milk sugar and cane sugar in the order named. —R. A. Strong, *Essentials of modern artificial feeding of infants* Lancet-Clinic March 14, 1914.

1914

Experiments show that sugars vary in their rate of absorption, some being assimilated rapidly while others

distribute their nutriment over a longer period. For example, maltose is most promptly assimilated, cane sugar next and milk sugar slowest."

The condition in which dextrin-maltose is particularly indicated is in acute attacks of vomiting, diarrhea and fever. It seems that recovery is more rapid and recurrence less likely to take place if dextrin-maltose is substituted for milk sugar or cane sugar when these have been used and the subsequent gain in weight is more rapid.

"In brief I think it safe to say that pediatricians are relying less implicitly on milk sugar but are inclined to split the sugar element, giving cane sugar a place of value and dextrin-maltose a decidedly prominent place particularly in acute and difficult cases." —H. D. Hoskins, *Present tendencies in infant feeding* Indianapolis 31 J., July 1914

1915

"In the severe cases (of diarrhea) he (Benson) uses Flinckstein's casein milk with malt sugar. He also believes that dextrin-maltose is to be preferred to milk sugar or any other sugar, as the infants gain more rapidly and digest more easily this form of sugar." —R. A. Benson, *Observations on 1,800 artificialized infants*, Med. Century, Feb. 1915 p. 53 abstr. Arch. Pediat., 32 550-53 July 1915.

1915

"Until very recently we have taken it for granted that milk sugar was the best, but now many consider that malt sugar is even better. However the malt sugar is not used in its pure state, but in the form of extracts, as dextrin-maltose." —E. B. Lowry, *Over Baby Food* & Co., Chicago, 1915 p. 162.

1915

Cane-sugar (saccharose), like most of the other disaccharide, is not absorbed as such, but must first be split by the invertase of the intestinal secretion into the two glucoses, dextrose and levulose, which are readily absorbable. Maltose (malt-sugar) occupies an exceptional position among the disaccharide, in being partly absorbable as such. This is probably due to the fact that it can be split not only by the maltase of the digestive juices, but also by the same ferment being present and active in the circulating blood (Chittenden and Mendel)

Anticipating a little, we may mention that all cases, in which lactose may advantageously be replaced by other carbohydrates, are pathological, and without exception the result of unsuccessful attempts at artificial feeding; they will therefore be discussed under that head.

"Dextrin, intermediate between sugar and starch is physiologically nearer to the former; we shall have occasion to see that, under certain conditions, it may supplement sugar very advantageously. Given together with maltose it materially delays the fermentation of the latter; Stollé observes that the more complex the carbohydrate the longer fermentation is postponed."

All malted foods contain dextrin and there is reason to believe that their value largely depends on their being somewhat complicated; such at least is the opinion of Usuki and Stollé, who believe that a mixture of carbohydrates is more slowly absorbed than a pure sugar and therefore tends to check fermentation in the intestine. Southworth explains the matter more definitely by attributing the antifermentative action entirely to the dextrin, which is not fermentable as such, but only after it has been split into maltose, a process that takes place only gradually and in the later stages of digestion.

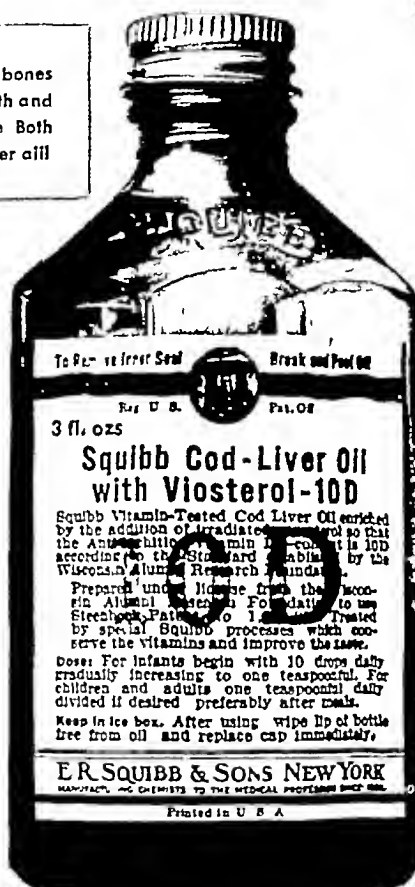
I make it a rule to give the ordinary formula with dextrin-maltose whenever the usual milk or cane-sugar mixtures seem to cause excessive fermentation and colic, or are attended with the evacuation of soap stools. I decidedly prefer this, as a preliminary measure to going over at once to some very low fat combination, which can only be a temporary makeshift at best. I also find dextrin-maltose an excellent addition to albumin-milk when the first object of that food has been achieved, and a gain in weight is desired. In this way I have succeeded in feeding albumin-milk far beyond the period usually advised with highly gratifying results." —F. L. H. Akerlin, *I feel Feeding, Its Principles and Practice* Lea & Febiger Phila., 1915 pp. 31 33 145 168

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